City of Kirkland Critical Areas Regulations Technical Report

Prepared for:

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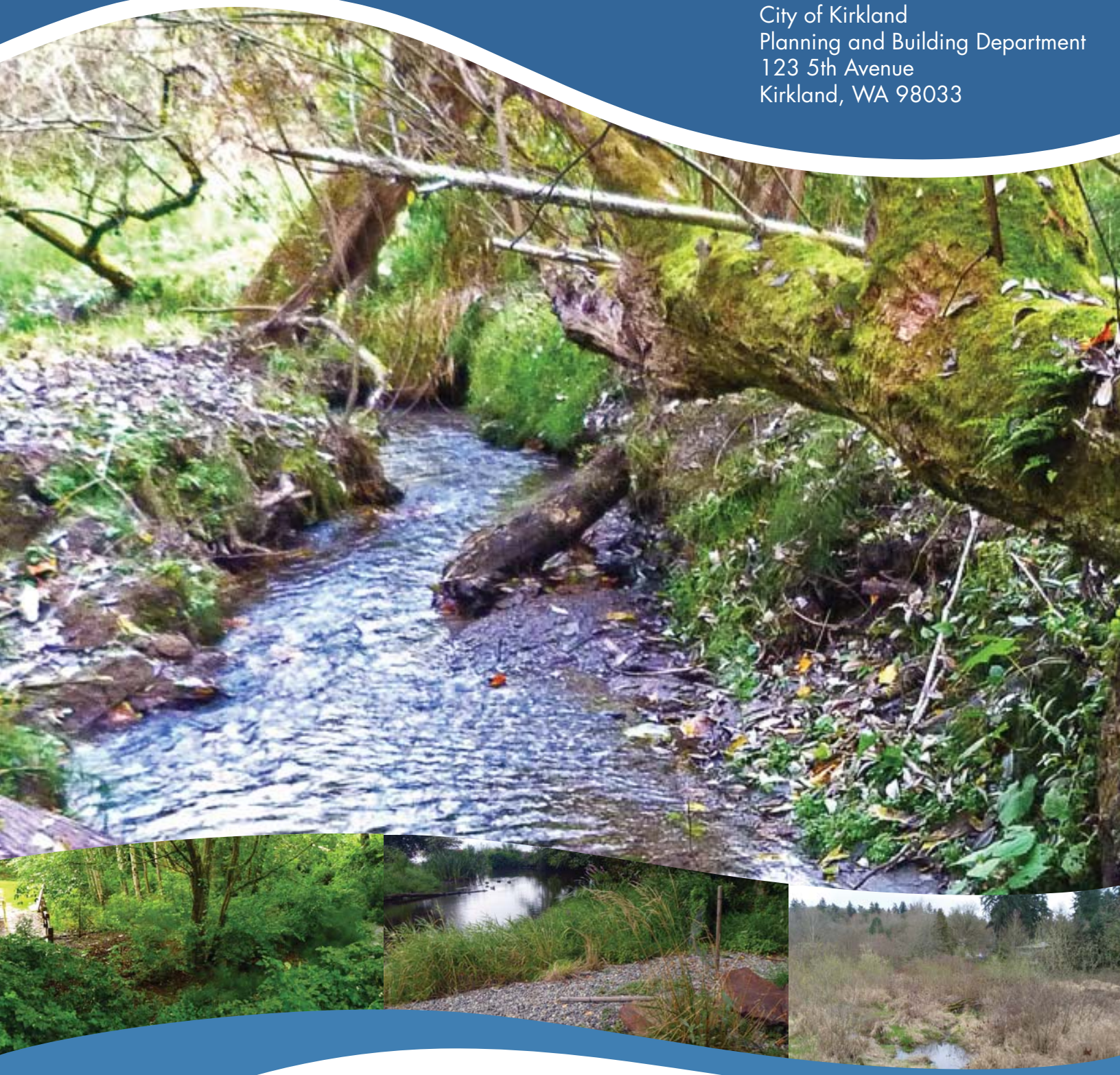

The Watershed Company

January 2016

CITY OF KIRKLAND CRITICAL AREAS REGULATIONS TECHNICAL REPORT

Part A- Review of Existing Conditions and Best Available Science
Part B- Gap Analysis

Prepared for:

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January 2016

The Watershed Company Reference Number: 151019

EXECUTIVE SUMMARY

To comply with Growth Management Act (GMA) mandates, the City of Kirkland updated its Comprehensive Plan in 2015, and is currently in the process of updating its Critical Areas Ordinance. The City last updated its critical areas regulations in 2002. Under the Growth Management Act, RCW 36.70A.130, the City was required to complete its periodic updates to the Comprehensive Plan and development regulations by June 30, 2015, and to update every eight years thereafter. Updates to Critical Areas regulations can be completed one year later. Thus, the state deadline is June 30, 2016, to adopt amendments to its Critical Areas Ordinance. To support the City's GMA-mandated Critical Areas Ordinance update, The Watershed Company prepared a two-part technical report, Part A – Review of Existing Conditions and Best Available Science, and Part B – Gap Analysis of the City of Kirkland's Critical Areas Regulations. These documents A) review existing conditions in the City and relevant science related to management of critical areas, and B) recommend updates to the City's critical area provisions that comply with State guidance and best available science (BAS).

Part A – Review of Existing Conditions and Best Available Science *(BAS)* describes critical area resources within the City of Kirkland (City) and documents BAS-based approaches to protecting the functions and values those areas provide. Existing conditions in the city are based on the city's GIS mapping, existing City documents, other publically available documentation, and The Watershed Company staff's familiarity with the City from many years of on-call environmental review and project work. The BAS review references recent BAS reports prepared for nearby jurisdictions and new information relevant to the City. Findings for wetlands; fish and wildlife habitat conservation areas (FWHCAs), including streams; and frequently flooded areas (FFA) are summarized in-brief below. The BAS review does not address geologically hazardous areas, as those areas are being reviewed separately.

- Wetlands: Kirkland contains more than 400 acres of mapped wetlands. Wetlands are highly productive ecosystems that are valued for providing water quality functions, hydrologic functions, and habitat functions. Primary BAS-based wetland protections include wetland identification, classification based on functions, and sufficiently protective buffers. When impacts to wetlands and/or buffers are proposed, mitigation sequencing, compensatory mitigation, and compliance oversight are central to maintaining wetland functions and values.

- Fish and Wildlife Habitat Conservation Areas (FWHCAs): Kirkland is on the eastern shoreline of Lake Washington, all 15 drainage basins within the city drain to Lake Washington. Several streams in the City provide habitat for salmonids, including state- and federally-listed species. Other priority species, including bald eagle, great blue heron, and pileated woodpecker are documented within the city. FWHCAs support a variety of functions, including dynamic instream habitats, water quality, streambank stability, organic inputs, and habitat connections across the landscape. Streams are typically protected through identification, classification, and protective buffers. When

priority habitats and/or species are present, Washington State Department of Fish and Wildlife (WDFW) species-specific management recommendations provide BAS-based management strategies.

- Frequently Flooded Areas (FFAs): Four floodplain areas are mapped within the city, three of them are associated with large wetland complexes, and most of the floodplain areas are within City-owned properties. Frequently flooded areas (FFA) are managed to reduce potential risks to public safety. FFAs can also provide valuable instream habitat benefits, such as low-velocity instream habitat during high-flow events. To comply with the conditions of the 2008 FEMA Biological Opinion and incorporate BAS on FFA functions, floodplain habitat assessments are required in addition to standard flood safety measures for projects within floodplains.

Part B – Gap Analysis of the City of Kirkland's Critical Areas Regulations reviews the existing critical areas regulations and identifies areas of the code that should be updated to be consistent with science-based recommendations. General recommendations concerning critical areas regulations organization and content are also provided in the gap analysis. Recommendations in the gap analysis are based on a review of the GMA requirements, the existing conditions and BAS review (Part A), current critical area regulations (KZC Chapter 90 – Drainage Basins), and recent updates to critical area regulations in neighboring jurisdictions. Critical area regulations will need to align with BAS practices, and any deviations from BAS recommendations must be documented and justified. In general, recommendations based on BAS-based guidance from the Department of Ecology are fairly prescriptive, whereas recommendations from primary BAS literature allow for more flexibility of policy implications and application to revising City code. Recommendations for Kirkland's critical areas code update are summarized in brief below. As with Part A, KZC Chapter 85 – Geologically Hazardous Areas, is not addressed in this gap analysis. The City has begun the process of updating Kirkland's geologic hazard maps using new advanced mapping tools such as Lidar, and then will evaluate the regulations in Chapter 85 once the mapping is done and after completion of the amendments to Chapter 90.

- Introduction summary: This code update provides an opportunity for the City to reorganize critical area regulations to better align with the definitions set forth in the GMA. The small wetlands exemption should be omitted or revised to align with BAS. General exceptions should be reviewed and clarified. Definitions could be reorganized and updated to reduce redundancy and better align with recent guidance and BAS.

- Wetlands: Wetland delineation criteria need to be based on the federal manual and regional supplement to align with Washington Administrative Code (WAC) 173-22-035. Wetland classifications should be based on the current 2014 Wetland Rating System for Western Washington (Ecology publication #14-06-029). Wetland buffer widths should be updated; there are multiple BAS-based Ecology guidance options for this update. Buffer modification options should be revised to limit allowances for buffer reductions. Mitigation sequencing requirements should be clarified to ensure that impact avoidance and minimization are analyzed ahead of mitigation design. Finally, the City should

consider how and when to allow use of off-site mitigation banking and in-lieu fee programs.

- Fish and Wildlife Habitat Conservation Areas, including streams: Stream regulations may be moved to a FWHCAs section for consistency with the WAC; provisions should be added for sensitive, threatened, and endangered terrestrial species and habitats. Stream classification should be updated; we recommend adopting the Permanent Water Typing System (WAC 222-16-030). Stream buffer widths, fencing/signage requirements, stream/buffer modification allowances, and mitigation requirements should all be updated to align with BAS. The City should review stream culvert provisions for consistency with WDFW design guidelines and to encourage stream daylighting.

- Frequently Flooded Areas: Frequently Flooded Areas are regulated, and floodplain habitat assessments are required under KMC 21.56 Flood Damage Prevention. Clarification of the relationship between terminology used in the KZC 90 (e.g., frequently flooded areas) and KMC 21.56 (e.g., areas of special flood hazard) should be considered.

- All Critical Areas – General Recommendations: The City should consider strengthening protective requirements and placing greater emphasis on mitigation sequencing (first avoid, then minimize, lastly mitigate). The City should further consider maximum development potential provisions relative to other density requirements in the City code. Reasonable use exceptions should be updated to add provisions for off-site mitigation. Bond requirements should be reviewed and revised to encourage compliance. Administrative provisions for appeals should be reviewed for clarity. We also recommend that the City provide more specific provisions for setbacks and nonconformance.

PART A

Review of Existing Conditions and Best Available Science

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1 INTRODUCTION

With passage of the Growth Management Act (GMA), local jurisdictions throughout Washington State (State), including the City of Kirkland (City), were required to develop policies and regulations to designate and protect critical areas. Critical areas, as defined by the GMA (Revised Code of Washington [RCW 36.70A.030(5)), include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas. The GMA directs jurisdictions to periodically conduct a thorough review and update their Comprehensive Plan and regulations (RCW 36.70A.130). When updating critical areas policies and regulations, jurisdictions must include the best available science (BAS). Any deviations from science-based recommendations should be identified, assessed and explained (Washington Administrative Code [WAC] 365-195-915). In addition, jurisdictions are to give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

The City of Kirkland updated its Comprehensive Plan in 2015. The City last updated its critical areas regulations in 2002. Under the Growth Management Act, RCW 36.70A.130, the City was required to complete its periodic updates to the Comprehensive Plan and development regulations by June 30, 2015, and to update every eight years thereafter. Updates to Critical Areas regulations can be completed one year later. Thus, the state deadline is June 30, 2016, to adopt amendments to its Critical Areas Ordinance. This deadline must be met for the City to remain eligible to receive funds from the public works assistance and water quality accounts in the State Treasury. Several jurisdictions within King County have recently updated their Comprehensive Plans, reviewed BAS, and updated their critical area regulations in advance of the GMA deadline. This report draws from work recently completed by other nearby jurisdictions related to the review of BAS. In proceeding with its update to regulations, the City will also have the opportunity to review and evaluate how other nearby jurisdictions have recently updated their critical areas standards.

This report provides an overview of the science relevant to the functions and values of wetlands, streams, and wildlife habitat, as well as brief description of existing critical areas in the City of Kirkland. This report does not address geologically hazardous areas, as these areas are being reviewed separately. Critical aquifer recharge areas have not been documented in the City of Kirkland; therefore, these areas are not addressed in any detail in this report. Rather than include a full and extensive review of general BAS related to critical areas, this report references recent BAS reports prepared for nearby jurisdictions and includes new information relevant to the City, as well as a description of local conditions. This approach increases efficiency and reduces the expense for the City of Kirkland. The BAS Review for the City of Woodinville Comprehensive Plan Update, available here (The Watershed Company 2014) provides a detailed and extensive review of the functions and values of streams, lakes, and associated riparian habitats, as well as recommendations for protecting those functions. Given

the proximity and general similarities in climate, topography, and development, the discussion of literature in the BAS Review for the City of Woodinville is considered to be generally applicable to the City of Kirkland. As such, this report provides a summary of key conclusions and recommendations derived from the body of literature discussed in the Woodinville BAS review. Additional BAS sources are described as necessary to address conditions specific to the City of Kirkland and new information available since the completion of the 2014 report.

In addition to the summary of BAS-based recommendations, the location, extent, and general conditions of existing critical areas in the City of Kirkland are identified based on available information. The report authors from The Watershed Company drew from familiarity through work experience in the City of Kirkland to describe existing conditions and to recommend updates to code provisions (see Part B- Gap Analysis). The Watershed Company's recent experience in the City of Kirkland includes work on the City's Surface Water Master Plan Update, stream and wetland reconnaissance mapping in the 2011 annexation area, stream and wetland reconnaissance and surveys of fish presence along the Cross Kirkland Corridor, work on the Environmental Impact Statement for the City's Comprehensive Plan Update, and general on-call environmental review. The Watershed Company also assisted the City of Kirkland in its Shoreline Master Program update (approved by Ecology in 2010).

This report is the first of a two-part technical report. Part B-Gap Analysis reviews the existing critical areas regulations and identifies areas of the code that should be updated to be consistent with science-based recommendations.

2 WETLANDS

2.1 Existing Conditions

Kirkland has more than 400 acres of mapped wetlands, with over 120 individual wetland areas and 9 wetlands that are larger than 8 acres (Kirkland 2014, Figure 2-1). Large wetlands in the city that provide complex habitat structure include, Forbes Creek wetlands, Big Finn Hill wetland, Heronfield wetland, Juanita Creek wetlands, and Yarrow Bay wetlands. Numerous other wetlands are also mapped throughout the City (Kirkland 2013). Smaller wetlands occur amidst more highly developed residential areas. Although isolated wetlands amidst developed areas may have relatively low functions for wildlife habitat, they often serve important roles for improving water quality and managing hydrology to limit localized flooding.

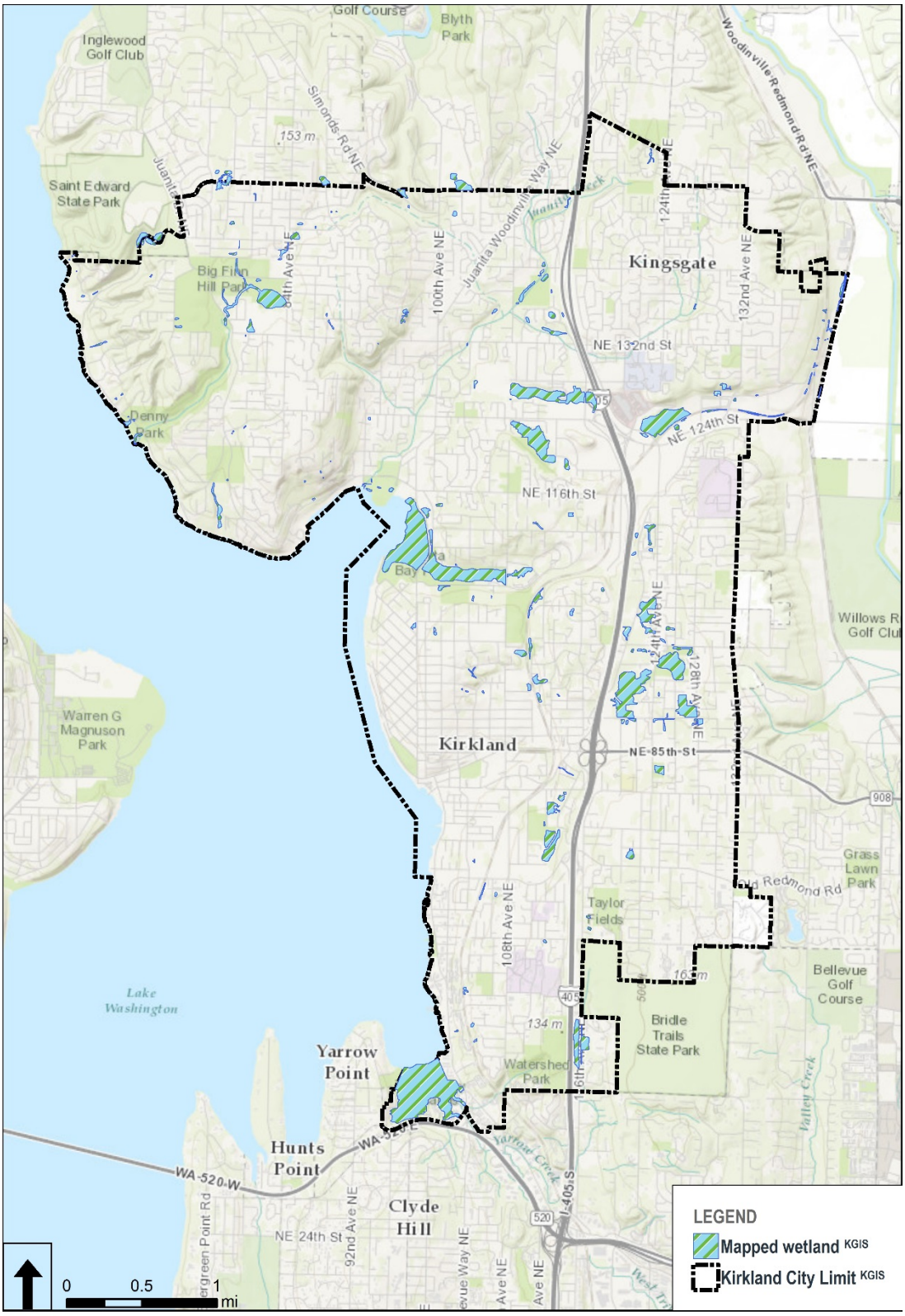
Per Kirkland Zoning Code (KZC) 90.75, "The majority, if not the entirety, of the perimeters of Totem Lake and Forbes Lake meet the definition of wetlands." Both of these small lakes are part of larger wetland complexes that span the surrounding landscape.

Forbes Lake is approximately 6.6 acres in total area. Volunteers have monitored water quality in Forbes Lake since 2006. Data indicate that the lake has medium to high primary productivity, meaning synthesis of organic biomass like plants and algae; it is considered to be at the

threshold of a eutrophic, or high nutrient-loaded, condition with fair water quality (Kirkland 2014).

The open water area in Totem Lake is just over three acres, but the combined area of emergent wetlands and open water is has been verified at just under 20 acres. Urban runoff and flooding has increased sediment transport to Totem Lake. Sediment accretion has reduced the area of open water by approximately 50% in the last 70-80 years (Kirkland 2013a). This trend occurs as runoff carries fine sediment into the waterbody, where it settles out and accumulates.

Wetlands are an important component of the surface water system, providing ecological values in the form of water quality filtering, flow attenuation, and they also provide significant habitat value for wildlife. Wetlands provide habitat for a unique and dense assemblage of plants and animals. In Kirkland, habitat functions are often limited by surrounding development, landscape-scale fragmentation, and proximity to Interstate-405.



Data Sources: WA Dept of Fish and Wildlife (WDFW), City of Kirkland GIS (KGIS, downloaded 11/30/2015), Esri.
Date: 12/11/2015

Figure 2-1. Mapped wetlands within the City of Kirkland

2.2 Best Available Science for Protection of Functions & Values

Wetland functions are affected by physical, chemical, and biological processes that occur within a wetland and the surrounding landscape (Sheldon et al 2005). Wetlands in the landscape provide essential conditions for growth of obligate and facultative-wetland plant species. Wetlands also provide habitat for reptiles, amphibians, birds, and mammals. Wetland scientists generally acknowledge that wetlands perform the following eight functions: 1) flood/storm water control, 2) base stream flow/groundwater support, 3) erosion/shoreline protection, 4) water quality improvement, 5) general habitat functions, 6) specific habitat functions, 7) cultural and socioeconomic values, and 5) natural biological support,. Natural biological support refers to the ability to support diverse lifeforms, and is based on a wetland's vegetation structure and diversity, landscape-scale connectivity, surface water conditions, and organic accumulation and export potential (Cooke Scientific Services 2000). Wetland functions for flood and stormwater control, erosion protection, and water quality improvement are particularly valuable to protect infrastructure and limit the effects of development on water quality in the area's streams, rivers, and lakes.

The primary tools regulators rely on to conserve wetland functions and values are: accurate wetland identification and classification, buffer widths and composition, mitigation sequencing, compensatory mitigation, monitoring and maintenance periods, and financial surety.

Identification and classification

Per WAC 173-22-035, wetland delineations shall be conducted in accordance with the federal wetland delineation manual and applicable regional supplements. The U.S. Army Corps of Engineers (Corps) Wetland Delineation Manual (Corps 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region Version 2.0* (Regional Supplement) (Corps May 2010) should be the applied methodology.

The Washington Department of Ecology (Ecology) Washington State Wetland Rating System is the most commonly used and regionally-accepted wetland classification system. This rating system was last updated in June 2014 (Hruby 2014; Ecology Publication No. 14-06-019). It is a four-tier wetland rating system, which grades wetlands on a points-based system in terms of functions and values. Ecology specifically developed this tool to allow for relatively rapid wetland assessment while still providing some scientific rigor (Hruby 2004). This rating system incorporates other classification elements, such as Cowardin (Cowardin et al. 1979), hydrogeomorphic) classifications (Brinson 1993), and special characteristics such as bogs and mature forests. As described in the Ecology Rating System guidance: "This rating system was designed to differentiate between wetlands based on their sensitivity to disturbance, their significance, their rarity, our ability to replace them, and the functions they provide" (Hruby 2004, Hruby 2014). The rationale for each wetland category under the Ecology Rating System is described below.

- Category I: These are the most unique or rare high-functioning wetland types that are highly sensitive to disturbance and/or relatively undisturbed wetlands with functions that are impossible to replace in a human lifetime.
- Category II: These wetlands are high functioning and difficult, though not impossible, to replace, and provide a high level of some functions.
- Category III: These wetlands provide a moderate level of functions and can often be adequately replaced with a well-planned mitigation project. They have generally been disturbed in some way and are characterized by landscape fragmentation and less diversity.
- Category IV: These wetlands are low functioning and can be replaced or improved. They are characterized by a high level of disturbance and are often dominated by invasive weedy plants.

Wetland categorization provides an important tool for managing impacts. "The intent of the rating categories is to provide a basis for developing standards for protecting and managing the wetlands. Some decisions that can be made based on the rating include the width of buffers needed to protect the wetland from adjacent development and permitted uses in, and around, the wetland" (Hruby 2014).

Wetland Buffers

Buffers are vegetated areas next to an aquatic resource that can protect it from or reduce the impacts of adjacent land uses. Buffers also provide terrestrial habitat for wetland-dependent species that need both aquatic and terrestrial habitats for their life-cycle (Sheldon et al. 2005; Hruby 2013). Widely recognized buffer functions include limited moderation of precipitation and stormwater inputs (hydrology maintenance), removal of sediment, excess nutrients, and toxic substances(water quality improvement), influencing microclimate, maintaining adjacent habitat critical for wetland-dependent species, maintaining habitat connectivity (wildlife habitat), and screening adjacent disturbances (disturbance barrier)(Sheldon et al. 2005). The factors that influence the performance of a buffer include vegetative structure, percent slope, soils, and buffer width and length. The scientific literature identifies four primary factors important in determining buffer width to adequately protect wetlands. These are 1) the functions and values of the subject wetland, 2) the characteristics of the buffer itself, 3) the intensity of surrounding land uses and their expected impacts and 4) the specific functions the buffer is intended to provide (Sheldon et al. 2005). Protection of wetland functions from effects of surrounding land uses is most commonly achieved through fixed buffers the size of which is based on wetland functions.

A synthesis of scientific studies summarizing, among other wetland topics, effectiveness of various buffer widths relevant to Western Washington was published by the Washington State Department of Ecology (Sheldon et al. 2005). Water quality is the wetland function that has been studied most comprehensively in the context of adequate buffer width. Water movement and quantity, habitat, and disturbance protection functions have been addressed to a lesser extent. General studies on stream buffer widths were also deemed relevant to discussions of wetland

buffer widths because a vegetated buffer often operates independently of the sensitive area it is intended to protect, particularly for "sink" functions such as sediment and pollutant removal. The effective buffer width ranges given below (Table 2.1) are broad and variations are largely dependent on buffer condition, landscape setting, and specific metrics. For example, effective buffer widths for water quality functions vary depending on the physical (slope and soil conditions), chemical (nutrient or contaminant loads), or biological (pathogens) conditions and input being treated. Similarly, effective buffer widths for wildlife habitat functions vary depending on the animal species the buffer is intended to protect.

Table 2-1. Range of Effective Wetland Buffer Widths in Existing Literature for Applicable Functions

Function	Range in meters (feet) of Effective Buffer Widths	Sources Consulted
Stormwater control (hydrology maintenance)	15-90 m (50-300 feet) (generally); vegetative structure and impervious surface in basin are more important factors	Wong and McCuen 1982; McMillan 2000; Azous and Horner 2001
Erosion control	Unknown: wetland size and buffer type are more important factors	Cooke Scientific Services 2000; Kleinfelter et al. 1992, in McMillan 2000
Water quality	5-100 m (15-325 feet)	Horner and Mar 1982; Lynch et al. 1985; Lee et al. 1999; Shisler et al. 1987, in McMillan 2000; Dillaha and Inamdar 1997; Daniels and Gilliam 1996; Magette et al. 1989; Sheldon et al. 2005
Wildlife habitat	14-90 m (45-300 feet)	Castelle et al. 1992b; Desbonnet et al. 1994; Semlitsch 1998; Richter 1997, in McMillan 2000; Cooke 1992
Disturbance barrier	14-60 m (45-200 feet)	Cooke 1992; Shisler et al. 1987, in McMillan 2000; Desbonnet et al. 1994

The synthesis of science review for buffers was re-evaluated by Ecology in 2013 (Hruby 2013). Most of the conclusions from the 2005 literature review are still valid (Sheldon et al. 2005; Hruby 2013). The primary conclusions of the 2013 review are as follows.

- Wetland buffer effectiveness at protecting water quality varies in conjunction with several factors, including width, vegetation type, geochemical and physical soil properties, source and concentration of pollutants, and path of surface water through the buffer.
- Wider buffers are generally higher functioning than narrower buffers.
- Depending on site-specific environmental factors, different buffer widths may be needed to achieve the same level of protection.
- To protect wetland-dependent wildlife, a broader landscape-based approach that considers habitat corridors and connections is necessary.
- Many animals, particularly native amphibians, require undisturbed upland habitats for their survival (Hruby 2013).

As noted above, the Wetland Rating System was developed to categorize wetlands in accordance with the level of sensitivity and significance, and the categories may be used as a

tool to assign appropriate buffer widths. For example, it is appropriate to provide the greatest buffer protection for the highest functioning wetlands that are most difficult to replace. In addition, because habitat protection requires the large buffers to protect the most vulnerable and sensitive species, those wetlands with higher habitat scores warrant wider buffers. In Kirkland, large wetlands that provide complex habitat structure, such as, Forbes Creek wetlands, Big Finn Hill wetland, Heronfield wetland, Juanita Creek wetlands, and Yarrow Bay wetlands may warrant buffers at the larger end of the recommended scale. On the other hand, lower functioning wetlands with low habitat scores typically primarily support water quality functions, and buffers at the smaller end of the range would tend to provide adequate protection for those functions. Buffers at the smaller end of the scale may be appropriate for small, structurally simple wetlands, with fragmented landscape connections resulting from adjacent development in the city.

Based on the above type of rationale, Ecology developed recommended buffer width management strategies in Appendix 8-C of Wetlands in Washington State, Volume 2 – Protecting and Managing Wetlands (Granger et al. 2005). Hruby's 2013 literature review of wetland buffer science did not prompt any new buffer width recommendations, although Ecology has updated its buffer width recommendations to correspond with the current outputs of the Wetland Rating System for Western Washington (Hruby 2014).

Mitigation Sequencing

To bolster protection of our national wetland resources, no net loss policy was adopted in 1988 and has been upheld through the present administration. The no net loss policy requires a balance between wetland loss due to development and wetland mitigation to prevent further loss of the country's total wetland acreage. In 2008, the U.S. Environmental Protection Agency (EPA) issued the Wetlands Compensatory Mitigation Rule. This rule emphasizes BAS to promote innovation and focus on results.

Wetland mitigation is typically achieved through a series of steps known as mitigation sequencing, a sequence of steps taken "to reduce the severity of an action or situation" (Ecology et al. 2006). Ecology recommends that the CAO contain clear language regarding mitigation sequencing. The mitigation sequence according to the implementing rules of the State Environmental Policy Act (SEPA) (Chapter 197-11-768 WAC) follows:

(1) Avoiding the impact altogether by not taking a certain action or parts of an action;

(2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;

(3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

(4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;

(5) Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and/or

(6) Monitoring the impact and taking appropriate corrective measures.

Compensatory Mitigation

Per Ecology, compensatory mitigation should replace lost or impacted wetland and buffer functions, unless out-of-kind mitigation can meet formally identified goals for the watershed. Ecology recommends prioritizing mitigation actions, location(s), and timing.

Mitigation Actions

Following mitigation sequencing, after demonstrating that a proposed wetland impact is unavoidable and has been minimized to the extent practical, compensatory mitigation is required by local, state and federal agencies. In general order of preference the agencies recommend wetland compensation in the form of: 1) re-establishment or rehabilitation, 2) creation (establishment), 3) enhancement, and 4) preservation (Ecology et al. 2006).

Wetland re-establishment or rehabilitation occurs when a historic or degraded wetland is returned to a naturally higher functioning system through the alteration of physical or biologic site characteristics. Re-establishment is typically achieved by restoring wetland hydrology; this may include removing fill or plugging ditches. Re-establishment achieves a net gain of wetland acres. Rehabilitation is achieved by repairing or restoring historic functions in a degraded wetland. Restoring a floodplain connection to an existing wetland by breaching a dike is an example of rehabilitation. Rehabilitation does not result in new wetland area.

Wetland creation is the development of a wetland at a site where a wetland did not naturally exist. Proximity to a reliable water source and landscape position are key design requirements for successful wetland creation (Ecology et al. 2006).

Both wetland enhancement and preservation result in a net loss of wetland acreage. Wetland enhancement typically increases structural diversity within a wetland, thus improving functions, or quality. Preservation of high functioning wetland systems in danger of decline may also be proposed as mitigation. While enhancement and preservation do not increase wetland acreage, these actions may result in long-term functional gains (Ecology et al. 2006).

Mitigation Ratios

Mitigation ratios are intended to replace lost functions and values stemming from a proposed land use while also accounting for temporal losses. Mitigation ratios recommended by Ecology in 2005 for wetland impacts can be found in Table 2-2 below. As noted above, the Corps and Ecology have a mandate to maintain “no net loss” of wetlands. Wetland creation and restoration are preferable to enhancement alone because wetland enhancement does not replace wetland area, and therefore, enhancement alone would result in a loss of wetland area. Ecology guidance does allow for enhancement as sole compensation for wetland impacts at quadruple the standard ratio (Granger et al. 2005). The higher ratios for enhancement-only are intended to

encourage actions that maintain existing wetland acreage and to ensure sufficient area of enhancement to retain wetland functions and values when a net loss of wetland acreage results.

Table 2-2. Ecology Recommended Mitigation Ratios (Granger et al. 2005)*

Category and Type of Wetland Impacts	Creation	Re-establishment-Rehabilitation Only	Creation and Rehabilitation	Creation and Enhancement	Enhancement Only
Category IV	1.5:1	3:1	1:1 C and 1:1 RH	1:1 C and 2:1 E	6:1
Category III	2:1	4:1	1:1 C and 2:1 RH	1:1 C and 4:1 E	8:1
Category II	3:1	6:1	1:1 C and 4:1 RH	1:1 C and 8:1 E	12:1
Category I: Forested	6:1	12:1	1:1 C and 10:1 RH	1:1 C and 20:1 E	24:1
Category I: Bog	Not possible	6:1 RH of a bog	Not possible	Not possible	Case-by-case
Category I: based on total functions	4:1	8:1	1:1 C and 6:1 RH	1:1 C and 12:1 E	16:1 E

*This document, Appendix 8-C of *Wetlands in Washington State*, *Volume 2 – Protecting and Managing Wetlands* (Granger et al. 2005).
Legend: C = Creation, RH = Rehabilitation, E = Enhancement

Credit-Debit Method

To give regulators and applicants a functions-based alternative to set mitigation ratios, the Washington State Department of Ecology recently developed a tool called the credit-debit method. This method, like the Ecology wetland rating form, is a peer reviewed rapid assessment tool. The credit-debit approach may be used to calculate functional gain of the proposed mitigation and functional loss due to proposed wetland impacts. This generates acre-points that can be compared in a balance sheet. Depending on specific site conditions, this may result in less or more mitigation than would be required under a set the standard mitigation ratio guidance (Hruby 2011). Both the ratios from Table 2-2 and the Credit-Debit Method are scientifically defensible methods to calculate required compensatory mitigation.

At present, the credit-debit method is used primarily for calculating credits for mitigation banks and in-lieu fee programs, such as the King County Mitigation Reserves Program. Other local jurisdictions still use mitigation ratios, as described above, yet many also allow the use of the credit-debit method to enable use of mitigation banks and in lieu fee programs. Because it is still early in the application of the credit-debit method, it is difficult to directly compare the outcomes of the credit-debit approach to use of mitigation ratios. Because it is a site-specific tool, it is expected that the credit-debit approach may result in higher or lower mitigation requirements relative to mitigation ratios depending on specific site conditions.

Mitigation Location

The Agencies (Ecology, Corps, and the U.S. Environmental Protection Agency Region 10) recommend selecting mitigation sites based on proximity to the impact and potential ability to replace impacted functions. In order of preference, a mitigation site should be:

> "in the immediate drainage basin as the impact, then the next higher level basin, then the other sub-basins in the watershed with similar geology, and finally, the river basin" (Ecology et al. 2006).

In the past decade, national and state policies have shifted toward using a broader scale approach for mitigation site selection. A recent forum convened by Ecology and composed of regulators, businesses, and environmental/land use professionals recommend that local jurisdictions "establish an ecosystem- or watershed-based approach to mitigation" (Ecology 2008). The ecosystem and watershed-based approach to mitigation looks beyond the property where the impact is proposed to evaluate if off-site compensatory mitigation within the local watershed is a viable option and would have greater benefit to ecosystem functions in the long-term. This is becoming more relevant as land use intensity increases and on-site mitigation has the potential to be more isolated on a landscape-scale, thus reducing some functional potential. Due to the limited success of on-site mitigation, particularly in highly developed areas, a broader watershed scale approach is increasingly desirable and is viewed by the regulatory agencies as more sustainable (Ecology 2008). To guide practical applications of BAS-based compensatory mitigation, the Agencies issued an Ecology publication, *Selecting Wetland Mitigation Sites Using a Watershed Approach* (Hruby et al. 2009). As noted by Azous and Horner 2001 (in Hruby et al. 2009), recreating or maintaining wetland functions in a highly developed landscape may not be sustainable. To account for this, the watershed approach may require a combination of on- and off-site mitigation to achieve functional gains equivalent to the proposed losses (Ecology et al. 2006).

Watershed-based planning is a way for local jurisdictions to manage ecologic resources sustainably. Ecology recently developed a Puget Sound Watershed Characterization project. This project provides a landscape-scale perspective to help planners manage their wetland and wildlife resources in a targeted and effective manner. It is a coarse-scale tool that uses GIS-based water flow, water quality, and habitat assessments to compare areas within a watershed for restoration and protection value (Ecology 2010).

Mitigation Timing

Mitigation actions may occur concurrent with the impact or before project impacts. The mitigation ratios provided by Ecology (Table 2-2) assume concurrent mitigation actions. The amount of mitigation required may be reduced for an advanced mitigation project that reduces the temporal loss of functions. In other words, compensatory mitigation that is completed at the time of impact will take several years to reach full functions; however, when mitigation is completed in advance of the impact, the mitigation area will be more mature and higher functioning at the time the impact occurs. Because the lag period between impact and mitigation is reduced or eliminated with advance mitigation, mitigation ratios may be reduced.

Compensatory Mitigation Approach

Compensatory mitigation can occur through permittee-responsible mitigation (on-site or off-site), mitigation banks, or in-lieu fee programs. In recent years, with permittee-responsible mitigation as the typical approach, several studies have concluded that despite regulatory mechanisms to ensure "no net loss" of wetlands, substantial loss has occurred, both in terms of wetland area and wetland functions (Turner et al. 2001,Johnson et al. 2002, Matthews and Endress 2008). Losses through compensatory mitigation have been attributed to poor restoration success (Race and Fonseca 1996, Turner et al. 2001, Johnson et al. 2002) and a lag time between impacts and mitigation (Bendor 2009).

Based on a review of twenty buffer mitigation projects in the City of Kirkland initiated between 2002 and 2010, eleven (55%) were judged to meet mitigation standards at the end of the standard five-year monitoring period, and 75% were released within 7 years. Ninety percent of sites meeting mitigation standards by Year 5 were initiated since 2006, indicating an improving trend, which may be related to mitigation plan review, maintenance, monitoring, or other factors.

The increased establishment and use of wetland mitigation banking and in-lieu fee programs has been proposed as a solution to the issues that affect on-site mitigation because 1) regulators can devote more time to monitoring and ensuring the success of mitigation banks, 2) mitigation bank sites are generally situated in an ecologically significant area, and 3) mitigation banks tend to aggregate projects into larger wetlands that may provide more functions than small, isolated wetlands (Bendor and Brozovic 2007; Keddy et al. 2009). The Agencies have stated that, "Mitigation banks provide an opportunity to compensate for impacts at a regional scale and provide larger, better-connected blocks of habitat in advance of impacts" (Ecology et al. 2006). Mitigation banks are also advantageous because mitigation credits generally become available in stages as the wetland permit conditions are met and restoration is successful. This helps minimize the lag time that can create a temporal loss in wetland function (Race and Fonseca 1996, Bendor 2009). Based on this and similar rationale, in 2008, EPA and the U.S. Army Corps of Engineers jointly promulgated regulations revising and clarifying requirements regarding compensatory mitigation, and establishing the following hierarchal preference for implementation of compensatory mitigation: ***Note: Delete "a" above***

1 Mitigation banks
2 In-lieu fee programs
3 Permittee-responsible mitigation under a watershed approach
4 Permittee-responsible mitigation through on-site and in-kind mitigation
5 Permittee-responsible mitigation through off-site or out-of-kind mitigation

Despite the theoretical merits of wetland banking, studies of wetland banking success have been largely equivocal in terms of its documented merits (Mack and Micacchion 2006, Reiss et al. 2009). A review of vegetative metrics of wetland banks from around the United States found that only 63% of mitigation banks over five years old would be considered successful (Spieles 2005). It is expected that the success rate has improved since that 2005 study as wetland

mitigation banking has become more common. Currently in King County, the Springbrook Creek Mitigation Bank is approved, but its service area does not extend into Kirkland, meaning that impacts in the city cannot be mitigated at the Springbrook Creek Mitigation Bank. Ecology and the Corps are reviewing the Keller Farm Mitigation Bank in Redmond, the service area of which would be expected to include Kirkland. Approved mitigation banks go through a rigorous state certification process. The certification process includes financial assurance requirements. Oversight from Ecology, the Corps, and other relevant agencies and a phased release of bond funds as mitigation bank performance standards are achieved help support mitigation success.

Another mitigation option is an in-lieu fee program. In-lieu fee programs are similar to mitigation banks, except that projects are implemented after credits are purchased, rather than before. In-lieu fee programs are operated by public agencies. The King County Mitigation Reserves Program (MRP) is an in-lieu fee program that was certified under 2008 federal rules. The program is designed to satisfy mitigation obligations for a wide variety of permit types and may be applied to City permits if the city code allows it. City of Kirkland is within the MRP service area. If allowed by local code, applicants within King County can use the MRP to buy credits for off-site mitigation. By purchasing credits, the applicant satisfies compensatory mitigation requirements and has no further involvement in the mitigation implementation. The MRP pools funds from the sale of credits in a given service area to develop mitigation sites from a predefined roster. The MRP plans, implements, monitors and maintains projects at chosen sites. At multiple points in the process, an Interagency Review Team will review and approve project proposals.

From an economic perspective, it may be more cost effective for small projects to pay a third party for mitigation credits through a mitigation bank or in-lieu fee program than to proceed with the design, permitting, and implementation of a small mitigation project (Bendor and Brozovic 2007). However, where in-lieu fee programs and mitigation banks include the cost of land acquisition, such as the MRP, credits tend to cost significantly more than on-site mitigation. Additionally, large projects may be able to plan, permit, and implement a large mitigation project for less than the cost of mitigation bank credits.

The City may wish to develop a policy prioritizing use of on-site versus off-site mitigation. The following considerations should factor into such a policy. From a landscape perspective, mitigation banking and in-lieu fee programs have a tendency to drive wetland mitigation from urban to rural areas (Bendor and Brozovic 2007). This migration may be driven by the lower cost of land in rural areas compared to urban areas or the availability of large areas of land for wetland restoration in rural areas (Bendor and Brozovic 2007; Robertson and Hayden 2008). A shift from small, urban wetlands to larger, rural wetlands may allow for a net increase in functions; however, small urban wetlands provide significant water quality functions and may be particularly important for controlling flooding in highly urbanized environments (Boyer and Polasky 2004), such as in the City of Kirkland. Urban wetlands may also provide recreational and educational opportunities and aesthetic values (Ehrenfeld 2000). Finally, developing urban wetlands may entail high "opportunity costs," meaning that once lost they will be difficult to

replace because of the high price of land in urban areas (Boyer and Polasky 2004). These factors should be considered when developing policies related to the use of mitigation banking and in-lieu fee programs in the City of Kirkland.

Mitigation Success

The Agencies recommend requiring financial assurances to ensure the success of a mitigation project. "Financial assurances may take the form of performance bonds or letters of credit. Applicants should check with their local planning department to determine if the local government will require performance bonds or other forms of financial assurances. A bond should estimate all costs associated with the entire compensatory mitigation project, including site preparation, plant materials, construction materials, installation oversight, maintenance, monitoring and reporting, and contingency actions expected through the end of the required monitoring period" (Ecology et al. 2006).

Compensatory mitigation projects should be protected in perpetuity. Legal mechanisms, such as deed restrictions and conservation easements, are typically used to achieve this (Ecology et al. 2006).

Additionally, physical site protection may be needed to keep people, pets, and equipment out of mitigation sites. Split-rail fencing and/or critical area signs indicating that the area should not be disturbed are typically required for site protection (Ecology et al. 2006).

3 Fish and Wildlife Habitat Conservation Areas

3.1 Streams and Lakes

Existing Conditions

The City of Kirkland is situated along the eastern shoreline of Lake Washington. The Lake Washington watershed (Water Resource Inventory Area 8) encompasses 692 square miles, collecting water from two major rivers (Cedar and Sammamish Rivers) before flowing through Lake Union and ultimately into Puget Sound via the Lake Washington Ship Canal and Hiram Chittenden locks. All streams and drainage basins in the city drain to Lake Washington. Shorelines and associated wetlands of Lake Washington are designated as Shorelines of Statewide Significance (WAC 173-20-370). Areas within 200 feet landward from the Ordinary High Water Mark of Lake Washington, as well as associated wetlands (namely Forbes Creek wetlands) are regulated under the City of Kirkland's Shoreline Master Program (KZC Chapter 83).

There are 15 drainage basins within the City of Kirkland, listed according to size in Table 3-1 and Figure 3-1. The basin analysis in Table 3-1 from the City's Surface Water Master Plan (Kirkland 2014) identifies conditions in each drainage basin, including all tributaries and contributing areas.

The City of Kirkland currently designates stream basins as primary or secondary based on salmonid[1] use. The following basins are identified as primary basins with documented use by salmonids: Juanita Creek, Forbes Creek, South Juanita Slope, Yarrow Creek, Carillon Creek, Denny Creek, and Champagne Creek. Secondary basins in the city are Moss Bay, Houghton Slope A, Houghton Slope B, Kirkland Slope, Holmes Point, and Kingsgate Slope. Salmonids are not documented within the secondary basins; however, in creeks draining directly to Lake Washington, such as streams in the Holmes Point Basin, use by salmonids is possible.

The City presently defines streams as, "Areas where surface waters produce a defined channel or bed that demonstrates clear evidence of the passage of water, including but not limited to bedrock channels, gravel beds, sand and silt beds, and defined-channel swales. The channel or bed need not contain water year-round. Streams do not include irrigation ditches, canals, storm or surface water runoff devices, or other entirely artificial watercourses, unless they are used by salmonids or convey a naturally occurring stream that has been diverted into the artificial channel" (KZC 90.30.16). A map of the city's streams, as well as documented fish passage barriers is provided in Figure 3-2.

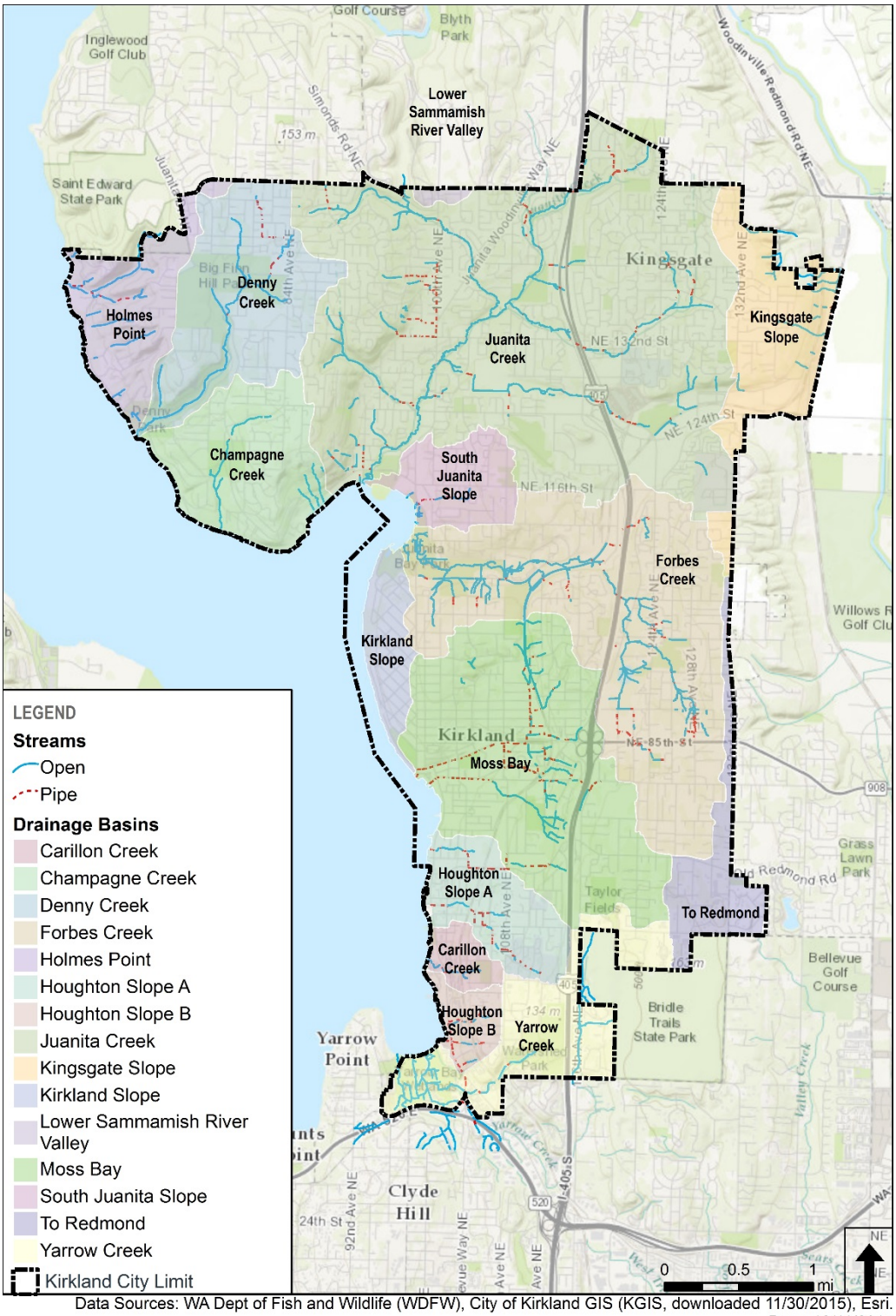
Table 3-1. Summary of Drainage Basin Features in the City of Kirkland

Basin	Area (Acres)	Total Stream Length (Miles)	Open Stream Channel (Miles)	Floodplain/ Floodway Area (Acres)	Existing impervious % of basin
Primary Basins					
Juanita Creek (Including South Juanita Slope	3,910	20.5	14.6	12.8	43
Forbes Creek	1,837	14.2	11.2	15.9 / 8.3	37
Denny Creek	804	3.9	3.2	NA	24
Champagne Creek	625	2.0	1.7	NA	30
Yarrow Creek	573	7.7	6.8	62.7	21
Carillon Creek	106	0.5	0.2	NA	38
Secondary Basins					
Moss Bay	1,487	9.3	4.8	2.5	46
Holmes Point	457	2.9	2.4	NA	22
Kingsgate Slope	564	2.5	2.4	NA	30
Houghton Slope A	376	2.75	0.8	NA	46
To Redmond	303	0.1	0.0	NA	38

[1] Salmonids include members of the fish family Salmonidae, which include Chinook, coho, chum, sockeye, and pink salmon; rainbow, steelhead, and cutthroat trout; brown trout; brook and dolly varden char; bull trout; kokanee; and white fish.

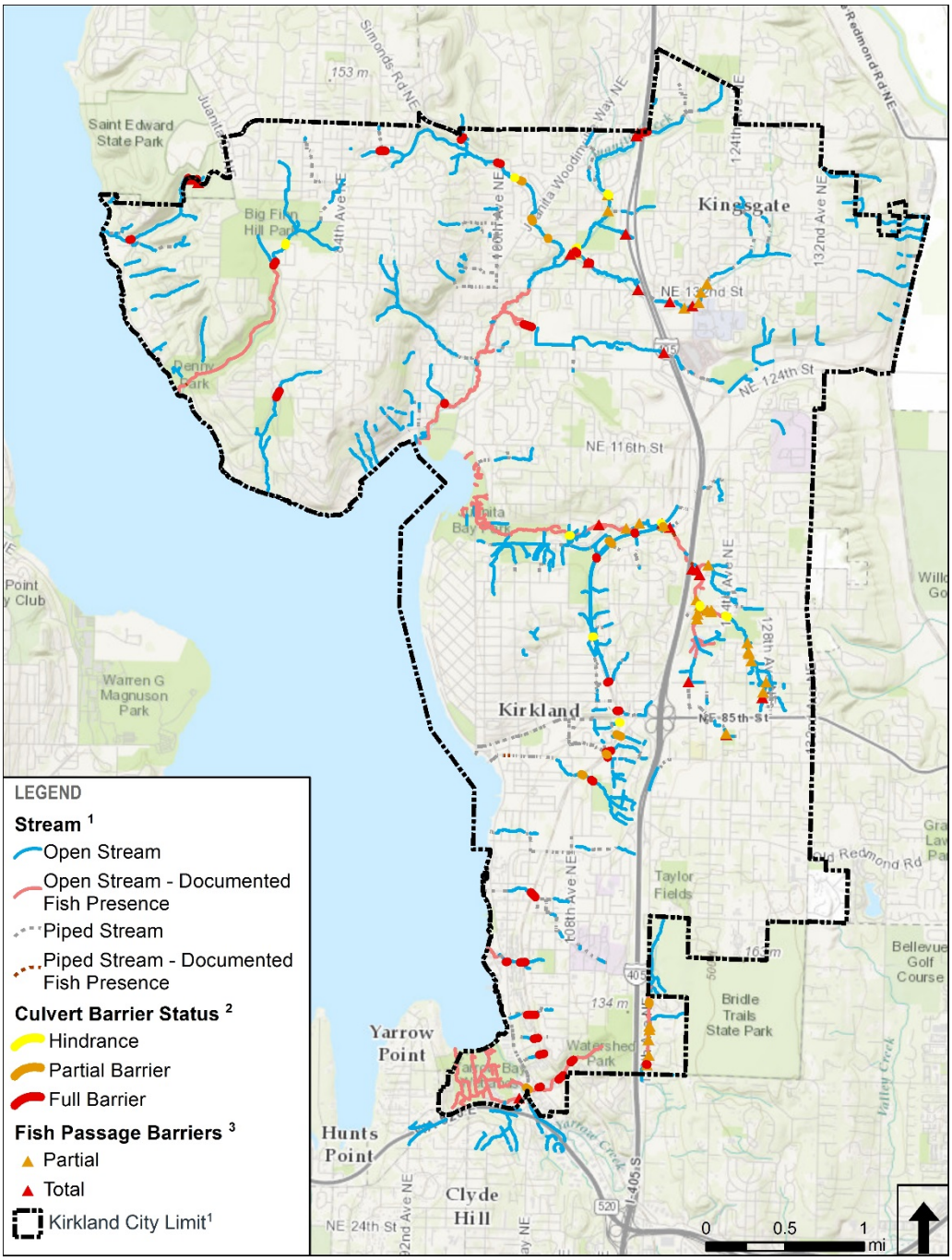
Basin	Area (Acres)	Total Stream Length (Miles)	Open Stream Channel (Miles)	Floodplain/ Floodway Area (Acres)	Existing impervious % of basin
Kirkland Slope	208	0.0	0.0	NA	39
Houghton Slope B	134	1.2	0.3	NA	41
Lower Sammamish River Valley	24	0.0	0.0	NA	41

Source: Kirkland 2014



Data Sources: WA Dept of Fish and Wildlife (WDFW), City of Kirkland GIS (KGIS, downloaded 11/30/2015), Esri.
Date: 12/11/2015

Figure 3-1. Map of Drainage Basins in the City of Kirkland



Data Sources:
1. City of Kirkland GIS, downloaded 11/30/2015.
2. The Watershed Company. August 2014. Fish Passage at City of Kirkland Road and Trail Stream Culverts- Preliminary Assessments.
3. Washington Department of Fish and Wildlife. July 2015. Fish Passage Barrier Inventory.
Service layer source: Esri

Date: 12/11/2015

Figure 3-2. Map of Stream Channels and Fish Passage Barriers in the City of Kirkland

The City's streams provide habitat for fish species of regional, state, and federal significance. In most cases, even non-fish bearing watercourses and water bodies provide important functions critical to maintaining productive downstream habitat conditions. Table 3-2 identifies the

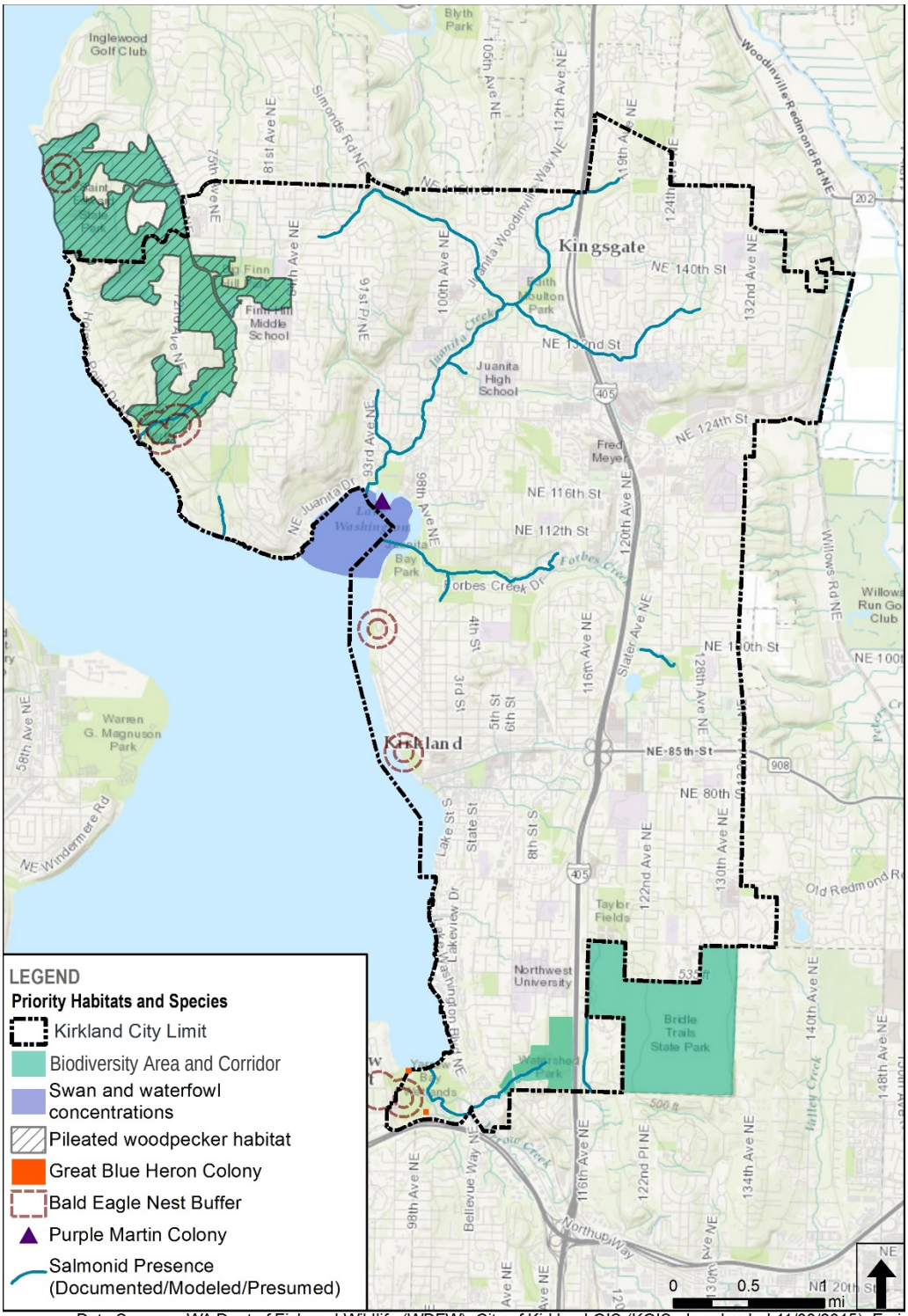
priority fish species occurring within the city's water bodies, as reported in the City of Kirkland's Stream, Wetlands, and Wildlife Study (The Watershed Company 1998) and in Washington Department of Fish and Wildlife (WDFW) Priority Habitat Species (PHS) data. Figure 3-3 shows PHS mapping, including mapping of streams with documented, presumed, and modeled salmonid presence.

Table 3-2. Priority Fish Species Occurrence in the City of Kirkland

Basins in City of Kirkland	Common Name	Scientific Name	State Status	Federal Status
Juanita Creek	Chinook Salmon	*Oncorhynchus tshawytscha*	C	T
	Steelhead	*O. mykiss*	C	T
	Coho Salmon	*O. kisutch*	--	SoC
	Sockeye/ Kokanee Salmon	*O. nerka*	C	--
	Cutthroat Trout	*O. clarkia*	--	--
Denny Creek	Chinook Salmon (modeled presence)	*O. tshawytscha*	C	T
	Steelhead (modeled presence)	*O. mykiss*	C	T
	Coho Salmon	*O. kisutch*	--	SoC
	Sockeye/ Kokanee Salmon (modeled presence)	*O. nerka*	C	--
	Cutthroat Trout	*O. clarkia*	--	--
Forbes Creek	Chinook Salmon (modeled presence)	*O. tshawytscha*	C	T
	Steelhead (modeled presence)	*O. mykiss*	C	T
	Coho Salmon	*O. kisutch*	--	SoC
	Sockeye/ Kokanee Salmon	*O. nerka*	C	--
	Cutthroat Trout	*O. clarkia*	--	--
Yarrow Creek	Chinook Salmon (modeled presence)	*O. tshawytscha*	C	T
	Steelhead (modeled presence)	*O. mykiss*	C	T
	Coho Salmon	*O. kisutch*	--	SoC
	Sockeye/ Kokanee Salmon (modeled presence)	*O. nerka*	C	--
	Cutthroat Trout	*O. clarkii*	--	--
Carillon Creek	Coho Salmon	*O. kisutch*	--	SoC
	Cutthroat Trout	*O. clarkii*	--	--
Champagne Creek	Cutthroat Trout	*O. clarkia*	--	--

Source: The Watershed Company 1998, WDFW 2015.

C=Candidate, T= Threatened, SoC= Species of Concern, Cutthroat trout is on the WDFW Priority Habitat and Species List.



Data Sources: WA Dept of Fish and Wildlife (WDFW), City of Kirkland GIS (KGIS, downloaded 11/30/2015), Esri.
Date: 12/22/2015

Figure 3.3. Map of Priority Habitats and Species data, including documented, modeled, and presumed salmonid use in the City of Kirkland. (Wetlands not included in map)

A description of the existing conditions of the city's watercourses and water bodies follows.

Juanita Creek

The largest basin in Kirkland, Juanita Creek originates east of I-405, and flows approximately five miles west and south entering Lake Washington on the west side of Juanita Beach Park. The lower reaches of Juanita Creek are confined to a narrow corridor, where bank armoring limits channel connectivity and complexity (King County 2002). There are three main tributaries flowing into Juanita Creek: an upper west (Simonds Tributary), a lower west, and a lower east (Totem Lake Tributary). The lower reach of the lower west tributary to Juanita Creek is confined to a pipe. The Totem Lake Tributary is also piped in places. Riparian corridors are highly altered, and erosion and instability of the stream bank is common (Kirkland 2014). The creek experiences rapid spikes in flow volumes immediately following rain events stemming from a high level of surrounding impervious surfaces (Kirkland 2014).

Water quality in Juanita Creek is listed as impaired for water temperature, fecal coliform bacteria, and dissolved oxygen by the 2012 Washington Department of Ecology's 303(d) list. King County maintained a 25-year record (1979-2004) of water quality conditions in Juanita Creek at two sampling locations, one located near the mouth, and the other located near NE 132nd St. Over that period, water quality degradation has been observed through increased water temperatures and conductivity at both locations and increased fecal coliform bacteria at the mouth; however, improvements through decreased total suspended solids and decreased nutrient concentrations have been noted over the same time period (King County electronic reference A). Fecal coliform levels have been high enough to result in periodic beach closures for swimming at Juanita Beach. These closures have occurred in 1998, 2000, 2005, 2007, 2008, and 2009 (King County electronic reference B). Typical closures last for several days; however in 1998, the closure lasted for two months, and in 2000, the closure lasted for three weeks. High fecal coliform levels were attributed to limited circulation and accumulation of goose feces. Notably, no swimming closures have occurred since renovations at Juanita Beach Park were completed. It is possible that these renovations effectively reduced the goose aggregations at the park.

The mainstem of Juanita Creek supports anadromous salmonids, including coho salmon and cutthroat trout, downstream from I-405. Existing vegetated buffer widths in the upper basin of Juanita Creek vary from 0 to 50 feet, although a wider buffer is present within Edith Moulton Park (The Watershed Company 1998). Residential development predominates throughout the upper Juanita Creek Basin. The lower reach of the western tributary just north of NE 124th Street is piped, and its confluence with the main stem presents a fish passage barrier. Several other complete fish passage barriers occur along the eastern tributaries of Juanita Creek (see Figure 3-2).

Forbes Creek

Forbes Creek drains from Forbes Lake and areas east of I-405 into the south side of Juanita Bay. Extensive riparian wetlands are present along the lower portion of Forbes Creek. The upper

portion of the creek is surrounded by residential and industrial development. Several small tributaries feed into Forbes Creek east of I-405. The mainstem originates at Forbes Lake, and other tributaries originate from extensive wetlands north and east of Forbes Lake. Culverts under I-405 limit hydrologic and habitat connectivity between the upper and lower portions of Forbes Creek (The Watershed Company 1998). The Moss Bay Basin, west of I-405, also drains north into Forbes Creek.

Higher and more frequent flows, due to increased development and reduced stormwater infiltration, have led to active channel downcutting and bank erosion in many reaches of the creek (Kirkland 2014). A stream survey in 2004 found that the lower reaches had limited potential to contribute large woody debris to the stream (via falling trees) because most of the surrounding wetland vegetation consists of smaller deciduous trees and shrubs (Parametrix 2004). The potential for adjacent forest to contribute large woody debris to the stream is variable in the upper watershed, reflecting the mix of forested and developed land uses there (Parametrix 2004).The frequency of deep, slow-moving pool habitats is low relative to fast-moving riffles and glides throughout the drainage (Parametrix 2004). Substrate composition is generally good, with low riffle embeddedness in fine sediment throughout most of the basin. The species composition of benthic invertebrates is commonly used as an overall indicator of water quality and stream habitat conditions, using a tool called the Benthic Index of Biotic Integrity (B-IBI). The B-IBI scores are rated as poor throughout the Forbes Creek Basin (Parametrix 2004).

Water quality in the lower reach of Forbes Creek, within Juanita Bay Park, is listed as impaired for water temperature, fecal coliform bacteria, and dissolved oxygen by the 2012 Washington Department of Ecology's 303(d) list. King County has monitored water quality near the mouth of Forbes Creek since 1979 (monitoring was discontinued from 2008-2012). Over the period from 1979 to 2007, nutrient loads and fecal coliform bacteria have decreased; however, stream temperatures and conductivity have increased, and dissolved oxygen concentrations have decreased (King County electronic reference A).

The lower mile of Forbes Creek is surrounded by a large emergent and scrub-shrub wetland complex. Anadromous fish occur from the mouth, upstream to I-405. Although not documented in the 1998 survey, resident cutthroat trout occur have been documented in one tributary east of the I-405 (see Figure 3-3).

Denny Creek

Denny Creek drains from north to south. The majority of the stream corridor is protected under public ownership, including Big Finn Hill Park and Denny Park. Within Denny Park, the riparian corridor is narrow, and there is evidence of previous channel stabilization efforts (Kirkland 2014). Upstream from Denny Park, mature forests provide a broad buffer from immediate land use impacts. However, drainage from surrounding developed residential areas may contribute to rapid spikes in flow volumes and significant erosion along the channel banks (The Watershed Company 1998). Plentiful large wood and boulders create hydraulic and aquatic habitat diversity within the channel (Kirkland 2014).

Large wood and boulders create hydraulic and aquatic habitat diversity within the channel (Kirkland 2014). Juanita Drive culvert is a complete barrier to fish movement, limiting anadromous salmon use in the basin (Kirkland 2014).

Champagne Creek

Champagne Creek is an independent drainage that enters Lake Washington at Champagne Point, north of Juanita Bay. It passes closely between several houses through their landscaped yards near its mouth. The stream channel shows signs of active erosion downstream of Juanita Drive and sediment deposition near the mouth (The Watershed Company 1998, Kirkland 2014). Upstream of the houses, it flows out of a fairly deep and steep-sided ravine, with ditch-like conditions in the upper reach (Kirkland 2014). In an analysis of sites likely to develop or redevelop, this basin was identified as having high potential for development and, the second largest potential for an increase in built-out impervious coverage over the next twenty years (Kirkland 2014).

Yarrow Creek

The Yarrow Creek drainage includes both Yarrow Creek and Cochran Springs Creek. The two creeks meet in the low gradient, 70+ acre, City-owned Yarrow Bay wetlands downstream from Lake Washington Boulevard, just prior to reaching Lake Washington. This large wetland complex was submerged by Lake Washington prior to the construction of the Chittenden Locks in the early 1900s; following construction of the Locks, the area was ditched and drained for agriculture. Today, the wetland complex is dominated by reed canarygrass and supports a beaver population. Sediment in the lower basin area is predominantly silts and sands, and past aggradation of sands and silts have resulted in flooding issues in the lower basin. Owners of the Plaza at Yarrow Bay conducted a project in 2013 to address flooding issues and enhance instream habitat downstream from Lake Washington Boulevard.

Both Yarrow Creek and Cochran Springs Creek are impacted by fish passage barriers, proximity to State Route 520, and proximity to developed areas. Fish passage improvements and instream habitat enhancements were recently completed on Yarrow Creek and a tributary to Yarrow Creek as a part of mitigation for the expansion of State Route 520.

Cochran Springs Creek originates from springs in Watershed Park, and the upper portion of the watershed is protected from development within the park. A fairly continuous corridor connects Cochran Springs Creek and Watershed Park.

Carillon Creek

Carillon Creek flows from east to west, originating in Carillon Woods and entering Lake Washington just north of Carillon Point. There is a significant elevation change between the upstream and downstream portion of the creek. Erosion in the upper portion of the basin has caused sedimentation of the downstream portion of the creek (City of Kirkland 2014). This sedimentation has degraded habitat and resulted in flooding issues. An open space area corridor in the upper basin in Carillon Woods buffers the upper creek from impacts from

surrounding suburban land uses. Like Cochran Springs Creek, springs in the Carillon Creek Basin provide fairly steady year-round flows (The Watershed Company 1998).

As a part of King County Water District 1, Carillon Creek served as the water supply to the Town of Yarrow Point until approximately 2003. Anadromous and resident salmonids are present in the lower reach, but have not been documented above the railroad grade embankment (The Watershed Company 1998).

Coho salmon and cutthroat are present below Lake Washington Boulevard, but have not been documented in the upper watershed (The Watershed Company 1998).

Secondary Urban Drainages

Secondary basins designated by the City are Moss Bay, Houghton Slope A, Houghton Slope B, Kirkland Slope, Holmes Point, and Kingsgate Slope. With the exception of the Holmes Point Basin, areas currently designated as secondary basins consist of small urban drainages. These drainages include small spring-fed creeks, the lower reaches of which are predominantly piped. Notable areas of open channels in these small urban drainages occur in and upslope of Everest Park; near Peter Kirk Elementary; and through steep ravines along the Houghton Slope (The Watershed Company 1998). No fish have been detected in these secondary urban drainages during previous stream inventory efforts (The Watershed Company 1998).

The most significant area of contiguous wildlife habitat among the urban secondary drainages is in Everest Park and the surrounding wetlands and wooded areas. The area encompasses wetland, stream, and upland habitats with a variety of plant communities. A 1998 study also noted habitat features such as snags and cavities in this area (The Watershed Company 1998). Other open space patches occur along the Houghton Slope, including a riparian greenbelt along Northwest College Creek from the railroad tracks to Lakeview Drive NE and a riparian greenbelt along Houghton Creek downstream of Lakeview Elementary.

In contrast to the small urban drainages described above, the Holmes Point basin, which was annexed into the City of Kirkland in 2011, located in the far northeastern portion of the city, is characterized by high forest coverage, relatively low impervious surface coverage, and drainages are predominantly conveyed through open stream channels. Despite these characteristics, most of the lower section of Holmes Point Creek is armored and piped in places, includes a concrete dam, which is a fish passage barrier, and has limited buffer areas from adjacent development (Kirkland 2014). The stream is also impacted by channel instability, fish passage barriers, and large man-made debris (Kirkland 2014). A unique zoning designation, the Holmes Point Overlay Zone, requires significant trees and native vegetation retention and restricted lot coverage. The term “secondary basin” and classification of fish use here may be somewhat misleading, since the lowermost portions of streams flowing directly into Lake Washington may support use by salmonids.

Best Available Science for Protection of Functions and Values

The BAS Review for the City of Woodinville Comprehensive Plan Update (The Watershed Company 2014) provides a full review of the functions and values of streams, lakes, and associated riparian habitats, as well as recommendations for protecting those functions. Given the proximity and general similarities in climate, topography, and development, the summary and discussion of literature in the BAS Review for the City of Woodinville (here) is considered to be generally applicable to the City of Kirkland.

The review addresses the role of riparian areas in maintaining stream functions important for supporting diverse and productive fish populations. These functions relate to:

- Water quality (i.e. sediment, nutrients, metals, pathogens, herbicides, and pharmaceuticals)
- Water temperature and microclimate
- Bank stability
- Invertebrate communities
- Inputs of organic detritus
- Instream habitat complexity, including large woody debris
- Dynamic habitat corridors

In an analysis of riparian zone ordinances, Wenger and Fowler (2000) support using approaches that allow some flexibility in how policies are implemented on a parcel scale. Variable-width buffer policies (i.e. policies that may vary depending on slope, soil type, and land use intensity) provide greater adaptability to address site-specific conditions; however, fixed buffer widths are more easily established, require a lesser degree of scientific knowledge to implement, and generally require less time and money to administer (Castelle and Johnson 1998).

Updates to critical area regulations within some other jurisdictions (e.g. King County, Thurston County, City of Redmond) have utilized a variable width approach in which stream buffers may be larger/smaller depending upon connectivity to special aquatic areas such as Puget Sound or other Shorelines of the State. Buffer averaging provides another example of flexibility, where limited reductions in riparian zone width are allowed so long as they are offset by wider riparian zones in adjacent areas. This type of approach is particularly effective if implemented such that the wider buffer areas are located in areas that protect specific functions. For example, research into water quality functions has found that source areas (areas where surface runoff first becomes channelized) are most important to protect to infiltration functions. Therefore, to maintain water quality functions, the buffer might be expanded to an area where surface runoff is likely to become channelized, such as existing depressions or swales. Another example would be to expand the buffer width in an area where it will contribute to habitat corridor connectivity.

If fixed-width buffers are implemented, conservative (larger) buffer widths are recommended in order to ensure that riparian buffers are effective under a range of variable conditions (Haberstock et al. 2000). Table 3-3 summarizes the ranges of effective buffer widths based on

each function, as described in the BAS Review for the City of Woodinville Comprehensive Plan Update (The Watershed Company 2014).

Table 3-3. Range of Effective Buffer Widths for Each Applicable Riparian Function

Function	Range of Effective Buffer Widths	Notes on Function
Water Quality		
Sediment	4-30 m (13-98 feet), up to 120 m (394 feet) for fine sediment	Filtration is widely variable depending on slope and soils.
Nutrients	Subsurface flow: not dependent on buffer width Surface flow: 15-131 m (49-430 feet)	In addition to buffer width, the rate of nutrient removal is dependent on infiltration, soil composition, and climate. Filtration capacity decreases with increasing loads, so best management practices that reduce nutrient loading will improve riparian function.
Metals	NA- Appropriate buffer width not established	Stormwater system improvements to slow and infiltrate runoff could help reduce metals entering aquatic systems.
Pathogens	NA- Appropriate buffer width not established	Minimizing the density of septic systems, maximizing the distance of septic systems from aquatic resource areas, and promoting pet waste management will help limit the transport of pathogens to aquatic systems.
Herbicides	6-18 m (20-59 feet)	Best management practices during application of herbicides and pesticides can help limit leeching to groundwater.
Pharmaceuticals	NA- Appropriate buffer width not established	Best management practices for disposal of pharmaceuticals may limit potential impacts.
Bank Stabilization	10-30 m (33-98 feet)	Beyond 98 feet from the stream, buffers have little effect on bank stability.
Stream Temperature	10-30 m (33-98 feet)	Percent areal cover/tree canopy is more closely related to stream temperature than buffer width.
Microclimate	(10-45 m) 33-150 feet	Most microclimate changes occur within 10-45 m (33 to 150 feet) from the edge, but microclimate effects extend over 240 m (790 feet) from the forest edge.
Invertebrates and Detritus	30 m (98 feet)	Areas with 10 m (33 feet) buffers exhibit changes in invertebrate community composition.
Wildlife Habitat	100 to 600 feet	Minimum width for supporting habitat varies among taxa, guides, and species. Functions include both corridor (travel and migration) and support of lifecycle stages, including breeding.

Function	Range of Effective Buffer Widths	Notes on Function
In-stream Habitat (large woody debris – LWD)	18-50 m (59 to 164 feet)	Most LWD is recruited from the area within one tree-height width from the stream, however, tree-fall from beyond that area may still affect LWD loading.

The review of science acknowledges several limitations of applying the results of primary scientific literature to policy decisions. In particular, it is important to recognize the setting of scientific investigations, as management recommendations differ between undeveloped forested environments and highly developed urban areas. For example, in urban areas, it is important to account for the presence of engineering and public works projects, such as surface-water detention facilities that may alter hydraulic conditions and sediment transport, or stormwater routing, which may cause runoff to bypass riparian areas altogether. Another consideration when evaluating primary literature is that scientific references commonly evaluate the effects of a single set of conditions, or in some cases several specific conditions. Depending on the specific conditions and function tested, outcomes may vary. Thus, although stream and riparian conservation measures should be based in BAS, some level of policy interpretation must be made by each local jurisdiction based on local conditions.

To achieve improved water quality in the city's streams, riparian buffer areas should be utilized effectively to provide both biofiltration of stormwater runoff and protection from adjacent land uses. Both of these goals can be achieved by providing dense, well-rooted vegetated buffer areas, and by protecting hydrologic source areas, including slope and depressional wetlands. Hydrologic source areas may also be protected by allowing for buffer averaging, where wider buffer areas apply in areas where surface water is likely to collect.

In addition to riparian buffers, the literature points to a range of recommended management measures to help maintain stream functions for fish and wildlife. Effective methods to reduce impacts from urbanization and associated runoff can include the following:

- Limiting development densities and impervious surface coverage
- Limiting vegetation clearing and retaining forest cover
- Concentrating impact activities, particularly roads, parking lots, and pollutant sources, away from watercourses
- Limiting the total area of roads and parking lots and requiring joint use of new access roads
- Protecting vegetation and limiting development on or near hydrologic source areas
- Low impact development (LID)
- Municipal stormwater treatment
- Public education
- Removal of fish passage barriers
- Daylighting of streams
- Removal or replacement of culverts to support passage of flood flows

Biofiltration swales, created wetlands, and infiltration opportunities for specific stormwater runoff discharges can be particularly effective to intercept runoff before it reaches stream channels. Stormwater runoff that is conveyed through stream buffers in pipes or ditch-like channels and discharged directly to stream channels "short circuits" or bypasses buffer areas and receives little water quality treatment via biofiltration. In areas where stormwater flows untreated through riparian buffer areas, the buffer is underutilized and is prevented from providing the intended or potential biofiltration function. Actions that increase filtration, including LID and targeted stormwater retrofits provide important opportunities to improve water quality and moderate the effects of development on flow conditions.

3.2 Terrestrial Habitat and Corridors

Existing Conditions

Kirkland contains several natural parks and open space areas, including Big Finn Hill Park, Denny Park, Juanita Bay Park, Everest Park, Carillon Woods, Yarrow Bay wetlands, Forbes Creek wetlands, and Watershed Park. The city parks provide terrestrial habitat patches and corridors to aquatic habitats within or adjacent to those parks. Watershed Park in the Yarrow Creek basin provides forested slopes, seeps, and riparian habitat. Habitat corridors between the Carillon Creek corridor and other open space corridors in the city are lacking. However, the riparian and upland communities within Carillon Woods provide a functional patch of forested and riparian habitat. Upstream from Denny Park, mature forests provide significant wildlife habitat. Beaver populations occur at several locations within the city, including Forbes Lake, the Forbes Creek wetlands, and the Yarrow Bay wetlands, as well as near the mouth of Juanita Creek. The lower Forbes valley is the longest connected open space in Kirkland, forming a nearly continuous corridor for wildlife movement (Kirkland 2014).

The City of Kirkland includes habitat types that are known to be used or could potentially be used by species of interest (excluding fish, which are discussed above), including those species with state or federal status and WDFW priority species. Mammals such as black-tailed deer, coyote, raccoon, and black bear occur in Kirkland. Habitats include forested upland, wetlands, riparian areas, scrub-shrub, and open habitat such as rights-of-way. Much of the northwestern portion of the city, particularly along Denny Creek and in Big Finn Hill Park is designated by WDFW as a Biodiversity Area and Corridor. This area is also identified as a pileated woodpecker breeding area. Mapped priority species and habitats are shown in Figure 3-3. Species designated as priority species by WDFW (based on their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance) that are likely to use habitat within the city are listed in Table 3-4. Because bald eagles and pileated woodpeckers are listed as Sensitive species by the State, their habitats are to be regulated as Fish and Wildlife Habitat Conservation Areas (FWHCA) per WAC 365-190-130. The City may elect to designate other PHS species or habitats, as well as other species or habitats within the city, as "Species of Local Importance" (WAC 365-190-130) as part of the update to the critical areas ordinance. It should be noted that only species mapped as occurring in the city are described below, and that other priority species, particularly highly mobile species may occur within the city. For

example, in the past couple of years, osprey, a PHS species, have nested near Lake Washington High School (Filan, J., City of Kirkland, personal communication).

Table 3-4. Mapped Priority Species in the City of Kirkland

Common Name	Scientific Name	State Status	Federal Status
Bald eagle	*Haliaeetus leucocephalus*	Sensitive	Species of Concern
Pileated woodpecker	*Dryocopus pileatus*	Sensitive	Species of Concern
Great blue heron	*Ardea herodias*	Monitor	None
Purple martin	*Progne subis*	Candidate	None
Trumpeter swan	*Cygnus buccinator*	None	None

Source: WDFW. PHS on the Web.

The meaning of state and federal statuses are described as follows:

- Federal Endangered: a species in danger of extinction throughout all or a significant portion of its range
- Federal Threatened: a species likely to become endangered in the foreseeable future throughout all or a significant portion of its range
- Federal Species of Concern: informal term, not defined in the federal Endangered Species Act, which commonly refers to species that are declining or appear to be in need of conservation
- State Endangered: wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state
- State Threatened: wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats
- State Sensitive: wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of their range within the state without cooperative management or removal of threats
- State Candidate: fish and wildlife species that the Department will review for possible listing as State Endangered, Threatened, or Sensitive
- State Monitor: species that require management, survey, or data emphasis for one or more of the following reasons:
  - They were classified as endangered, threatened, or sensitive within the previous five years.
  - They require habitat that is of limited availability during some portion of their life cycle.
  - They are indicators of environmental quality.
  - There are unresolved taxonomic questions that may affect their candidacy for listing as endangered, threatened, or sensitive species.

- State Priority Species: species that require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance. Priority species include State Endangered, Threatened, Sensitive, and Candidate species; animal aggregations (e.g., heron colonies, bat colonies) considered vulnerable; and species of recreational, commercial, or tribal importance that are vulnerable.

Best Available Science for Protection of Functions and Values

General recommendations for terrestrial habitat are listed in the following section. Where species-specific recommendations are available for Washington State from WDFW guidance documents, these are summarized separately below. WDFW species- specific recommendations are often referenced in local jurisdictions' critical areas regulations.

General Terrestrial Habitat Management Recommendations

Recommendations

- Generally, plan development to minimize fragmentation of native habitat, particularly large, intact habitat areas. Where large forest stands exist, manage for sensitive species and avoid fragmentation (Donnelly and Marzluff 2004, Diffendorfer et al. 1995, Mason et al. 2007, Orrock and Danielson 2005, Pardini et al. 2005 and others).
- Control invasive species where needed on a site- and species-specific basis. Address invasive species on a landscape scale, particularly focusing on areas where environmental conditions tend to promote infestation, including created edges, roadways, and riparian zones where they are contiguous with developed areas that may act as a seed source (Olden et al. 2004, Pimentel et al. 2005, McKinney 2002 and others).
- Maintain or provide habitat connectivity with vegetated corridors between habitat patches (Schaefer 2003, Clair 2008, Gilbert-Norton et al. 2010 and others).
- Protect, maintain, and promote habitat features such as snags and downed wood (Blewett and Marzluff 2005).
- Manage for increase native vegetative cover in landscaping and discourage lawns (Nelson and Nelson 2001).
- Plan habitat areas away from roads (Fahrig et al. 1995, Lehtinen et al. 1999).
- Promote buffers of adequate width to support wildlife guilds in adjacent habitat (Semlitsch and Bodie 2003, Crawford and Semlitsch 2007).
- Preserve habitat patches of at least moderate size 35 ha (86 ac) within developed areas (Kissling and Garton 2008).

WDFW Species-specific Management Recommendations

Bald Eagle

Bald eagles are likely to be detrimentally impacted by activities that alter nest, roost, or perch trees; removal of adequate buffers; noise and other human disturbance; and potentially

decreasing salmon runs (Watson and Rodrick 2000). There are currently 5 mapped nesting sites in the city, all of which are in close proximity to Lake Washington. WDFW previously required bald eagle management plans for development within the vicinity of a bald eagle nest. Since the state changed the bald eagle status from threatened to sensitive, the state no longer asserts regulatory authority over bald eagle management, nor does it provide current management recommendations. Nevertheless, previous WDFW management recommendations are still relevant to protecting this State-listed sensitive species. These recommendations focus on establishing management areas associated with different habitat features (e.g., nesting, roosting, perching), as summarized in in Table 3-5. Nesting recommendations are relevant to the City of Kirkland.

Exact activities and protections within each zone may vary by site, but generally should include retention of large trees and restriction of most construction (Protected Zone), and protection of alternate nest locations, perch trees, and foraging sites and avoidance of construction use activities that are not low-impact. Non-nesting protections include retaining and protecting perch trees and buffering foraging sites from disturbance.

Table 3-5. Bald eagle protection zones from Watson and Rodrick 2000

Habitat	Zone	Distance	Management Practice
Nesting tree	Protected Zone	120 m (400 feet)	Retain all existing large trees; avoid construction; during March-July, the nesting/fledgling season, limit noisy activities
	Conditioned Zone	100-240 m (330-800 feet) beyond Protected Zone	Avoid constructing noisy industrial facilities or multi-story buildings. Avoid constructing new roads or trails within sight of the nest. Limit noisy activities during nesting/fledgling season (March-July).
Communal Roost Sites	Human Disturbance Zone	100 m (400 feet)	Limit noisy activities during critical roosting period (November 15 - March 15)
Perching and Foraging	Perch Protection	75 m (246 feet) of top-of-streambank or shoreline	Protect known or potential perches greater than 20 inches diameter at breast height within 75 m (246 feet) of top-of-streambank or shoreline
	Human Disturbance and Structures	450 m (1,500 feet)	Limit human disturbance or permanent structures.

Pileated Woodpecker

Documented breeding pileated woodpecker habitat is mapped within O.O. Denny Park, Big Finn Hill Park, and St. Edwards State Park, as well as heavily forested areas adjacent to these parks. These areas include some of the few areas that include large snags in the City of Kirkland. WDFW management recommendations for pileated woodpecker specific to western Washington are aimed at forest stand features and protection strategies within home ranges rather than creation of buffers for individual nest sites. Maintaining snags and decaying live trees within home ranges for nesting and roosting, retaining snags and downed wood for foraging, using average snag-retention recommendations (rather than minimums), and creating snags in older secondary forest are general strategies (Lewis and Azerrad 2003 with January 2005 updates). In western Washington, home range size is on average 600 ha (1480 ac), west of the Cascades and about 850 ha (2100 ac) on the Olympic peninsula. Maintenance of coniferous forest of about 60 years or more in age at 70% canopy cover is recommended overall. Snag retention recommendations are given in Table 3-6.

Table 3-6. Snag retention recommendations for pileated woodpecker (from Lewis and Azerrad 2003 with January 2005 updates)

Habitat component focus	Size class (dbh)	Snags to retain (per ac)
Nesting and roosting	≥76 cm (≥30 in)	≥0.2
	155-310 cm (61-122 in)	≥7
Foraging	25-50 cm (10-20 in)	≥7
	50-76 cm (20-30 in)	≥3
	≥76 cm (≥30 in)	≥2

Great Blue Heron

In Kirkland, two great blue heron breeding colonies are mapped in the Yarrow Bay wetlands. WDFW recommends protection mechanisms for Heron Management Areas, which consist of the nesting colony, year-round and seasonal buffers, foraging habitat, and congregation areas where they exist (Azerrad 2012). Specifically, clearing vegetation, grading, and construction should never occur in the core zone (breeding area and year-round management zone), and other potential disturbances, including recreation and vegetation management, should be minimized or restricted to the period outside of the breeding season. Foraging habitat should be protected with riparian buffers, and activities such as vegetation removal, logging, perch tree disturbance, wetland filling, and construction should be minimized. Heron colonies closer to human activity may tolerate more disturbance than colonies in more undisturbed areas; therefore, appropriate buffers may be smaller in more developed areas. Year-round and seasonal management recommendations are provided in Table 3-.

Table 3-7. Great blue heron recommended management zones from Azerrad 2012

Adjacent land use	Distance from Nesting Colony	Management Practice
Undeveloped (0-2% developed area)	300 m (984 feet)	Avoid clearing vegetation, grading, and construction year-round

Adjacent land use	Distance from Nesting Colony	Management Practice
Suburban/rural (3-49% developed area)	200 m (656 feet)	
Urban (>50% developed area)	60 m (196 feet)	
All Uses	200 m (656 feet)	Avoid loud noises February-September
	400 m (1320 feet)	Avoid extreme loud noises February-September

Purple Martin

In Kirkland, nesting purple martin have been documented in gourds and cavities in abandoned pilings in Juanita Bay. The decline of the purple martin is attributed to the lack of snags containing nest cavities, as well as competition for nesting cavities with more aggressive species. Purple martins use cavities excavated by such species as pileated woodpeckers; therefore managing for pileated woodpeckers (see recommendations above) will indirectly benefit purple martins. Additional management recommendations for purple martin that apply to areas within the City of Kirkland are listed below (Hays and Milner 2003).

- Pilings with known purple martin nests in standing water and snags (especially snags near water) should be protected and left standing.
- Retain snags near wetlands.
- Snags can be created in forest openings, or at forest edges (e.g., by topping trees) where nesting cavities are lacking, especially within 10 miles of existing purple martin colonies.
- If natural sites are lacking and cannot be provided by manipulating habitat, artificial nesting structures can be provided. New colony establishment through the use of artificial nesting structures is only recommended if these structures will be maintained over time.

Trumpeter Swan

According to WDFW PHS maps, trumpeter swans and other waterfowl assemblages use Juanita Bay on Lake Washington. Trumpeter swans over-winter in Washington State, and the large emergent wetlands at the mouth of Forbes Creek likely provide an important foraging source for them. Conservation of these wetland habitats is expected to promote the continued use of the area. No other conservation measures are recommended for the species.

4 FREQUENTLY FLOODED AREAS

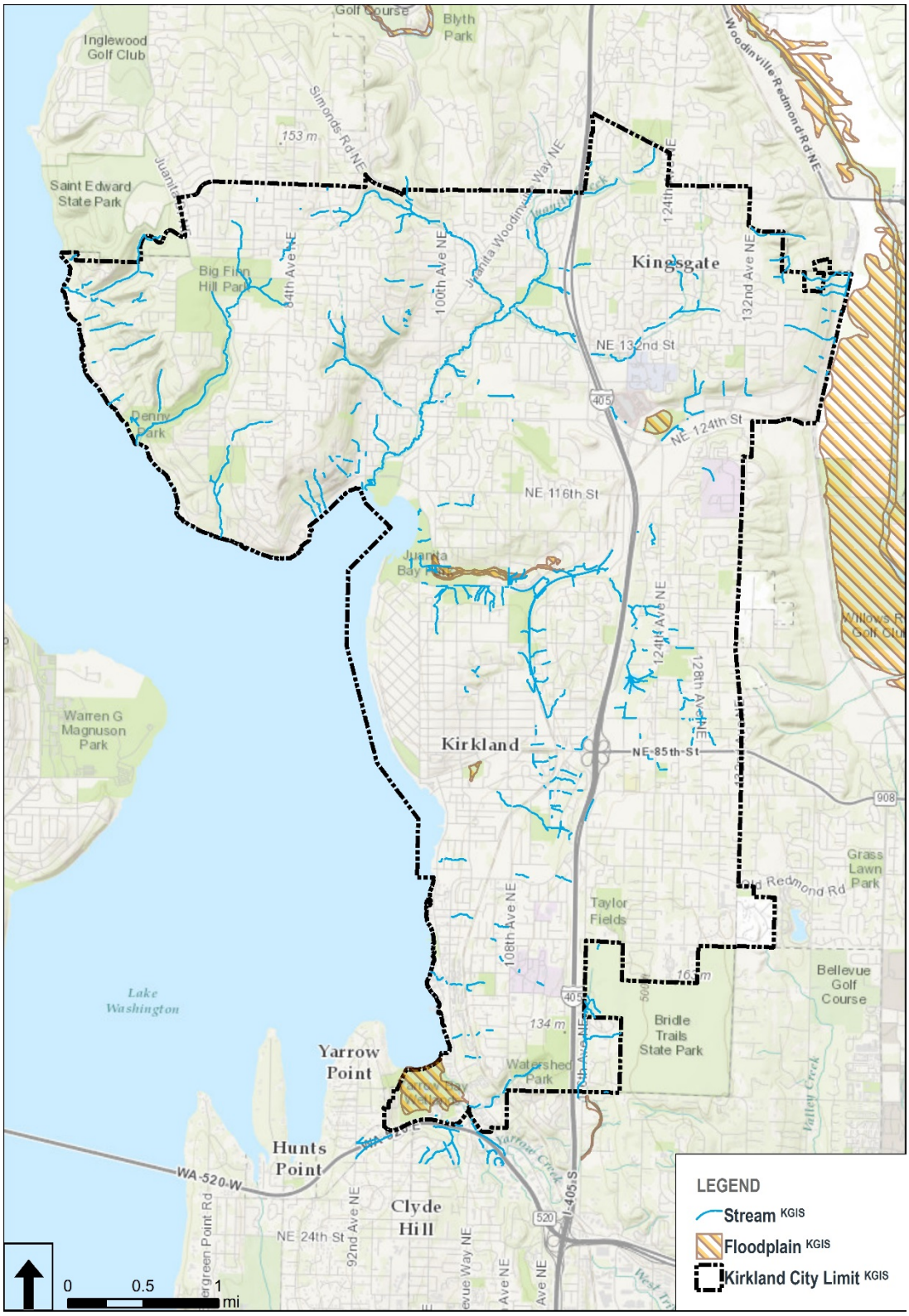
4.1 Existing Conditions

Frequently flooded areas (FFA) are regulated to manage potential risks to public safety. Such areas also provide valuable instream habitat benefits, such as low velocity habitat during flood

events. The City of Kirkland defines frequently flooded areas as areas within the 100-year floodplain.

Four floodplain areas are mapped within the City of Kirkland (Figure 4-1). Three of these floodplain areas are associated with large wetland complexes such as at Yarrow Bay, Totem Lake, and Forbes Creek near the mouth at Juanita Bay. However, the Moss Bay floodplain is located in a depression within the Peter Kirk ball fields; the adjacent stream is currently piped. Floodplain areas are predominantly, but not entirely, undeveloped and in public ownership.

Flooding within the city, with its small to mid-sized streams, is most often triggered by heavy rains, and exacerbated by runoff from impervious surfaces related to development.



Data Sources: WA Dept of Fish and Wildlife (WDFW), City of Kirkland GIS (KGIS, downloaded 11/30/2015), Esri.
Date: 12/11/2015

Figure 4-1. Mapped floodplain areas in the City of Kirkland

4.2 Best Available Science for Protection of Functions and Values

Frequently flooded areas are generally regulated to manage potential risks to public safety. Given the ecological role of floodplains in moderating flows, providing a source of organic material, and providing off-channel refuge for fish during high flows, the protection of floodplain functions is also important for maintaining ecological functions (The Watershed Company 2014).

A 2008 biological opinion related to the implementation of the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) in the Puget Sound Region summarizes the importance of floodplain functions for threatened salmonids and endangered southern resident killer whales (NMFS 2008). As a result of this biological opinion, cities and counties in the Puget Sound region are required to either amend regulations to protect floodplain functions or require habitat assessments for development in the floodway or floodplain. Through either approach, the city must ensure that development within the Special Flood Hazard Area (100-year floodplain) and riparian buffer zone, which extends 250 feet from the ordinary high water mark where a flood feature is present, does not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, or floodplain refugia for listed salmonids. The biological opinion also applies to mapped floodways and channel migration zones, neither of which occur in the City of Kirkland. The City already addresses the requirement to conduct a floodplain habitat assessment through its Flood Damage Prevention regulations (KMC 21.56.055). Therefore, no additional regulations are needed to protect floodplain habitat.

Standards that continue to protect human life from flood hazards and provisions that ensure compliance with the 2008 NFIP biological opinion will help ensure that floodplain ecological functions are maintained.

5 Other Critical Areas

Critical Aquifer Recharge Areas and Geologically Hazardous Areas are not addressed in this report. As described in the Kirkland Comprehensive Plan, the city does not rely on local aquifers for potable water. However, aquifers in the city contribute to base stream flows and may be susceptible to groundwater contamination. Geologically hazardous areas present within City of Kirkland include, erosion hazards, landslide hazards, seismic hazards, and other geologic event hazards. Best available science and best management practices for these types of critical areas have previously been addressed by the City. Updated mapping and a review of existing regulations is being conducted through a parallel process and is thus not part of this report.

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7 ACRONYMS AND ABBREVIATIONS

ac.....acres
BAS.....Best Available Science
CAO .....Critical Areas Ordinance
City.....City of Kirkland
cm .....centimeters
Corps .....U.S. Army Corps of Engineers
dbh .....diameter at breast height
Ecology .....Washington State Department of Ecology
EPA .....U.S. Environmental Protection Agency
FEMA.....Federal Emergency Management Agency
ft.....feet

FFA.....frequently flooded areas
FWHCA.....Fish and Wildlife Habitat Conservation Areas
GMA.....Growth Management Act
ha.....hectares
in.....inches
KZC.....Kirkland Zoning Code
LID.....Low Impact Development
LWD.....Large Woody Debris
m.....meter
NE.....Northeast
NFIP.....National Flood Insurance Program
PHS.....Priority Habitats and Species
SEPA.....State Environmental Policy Act
State.....Washington State
WAC.....Washington Administrative Code
WDFW.....Washington Department of Fish and Wildlife

PART B

Gap Analysis

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PART B TABLE OF CONTENTS

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1 INTRODUCTION

1.1 Overview and Purpose

With passage of the Growth Management Act (GMA), local jurisdictions throughout Washington State (State), including the City of Kirkland (City), were required to develop policies and regulations to designate and protect critical areas. Critical areas, as defined by the GMA (Revised Code of Washington [RCW 36.70A.030(5)), include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas.

An ongoing requirement of the GMA is for local jurisdictions to periodically review and evaluate their adopted critical areas policies and regulations. In accordance with the GMA, the City last completed a comprehensive update of its critical areas policies with the adoption of its 2015 Comprehensive Plan, and regulations were last updated in 2002. The City's critical areas regulations are currently codified in Zoning Code Chapters 85 - Geologically Hazardous Areas and 90 - Drainage Basins.

When updating critical areas policies and regulations, jurisdictions must include the best available science (BAS). Any deviations from science-based recommendations should be identified, assessed and explained (Washington Administrative Code [WAC] 365-195-915). In addition, jurisdictions are to give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Part A of this report, entitled, *City of Kirkland Critical Areas Regulations: Review of Best Available Science and Existing Conditions,* references BAS summaries and provides an overall description of the occurrence, distribution, and characteristics of critical areas in the city.

The purpose of this document is to provide a review of the City's current critical areas regulations, noting gaps where existing regulations may not be consistent with BAS, the GMA, and/or its implementing rules. General recommendations concerning critical areas regulations organization and content are also provided. This document does not attempt to identify every instance where the existing critical areas regulations might be amended, but instead focuses on identifying the most significant potential amendments. The primary intention of this gap analysis is to help guide the update of the City's critical areas regulations. The analysis will focus on Kirkland Zoning Code (KZC) Chapter 90, Drainage Basins. KZC Chapter 85, Geologically Hazardous Areas will be reviewed as part of a separate evaluation.

This document is the second part of a two-part technical report. Part A – Review of Existing Conditions and Best Available Science – provides an overview of the science relevant to the functions and values of critical areas, as well as a brief description of existing critical areas in the city.

1.2 Document Organization

This document follows the same basic organizational structure as the City's existing critical areas regulations. Each section of the report features a critical areas review summary that identifies gaps where the existing critical areas regulations may not meet BAS, the GMA, and/or its implementing rules. Where appropriate, the section also provides a brief comparison to analogous regulations in the City's Shoreline Master Program (SMP), adopted in 2010 and codified in Chapter 83 of the Kirkland Zoning Code (KZC). This comparison is intended to help maximize consistency throughout City code. To highlight findings of the critical areas review, a summary table is provided at the beginning of each critical areas review summary section.

2 CHAPTER 90 INTRODUCTION

Chapter 90 - Drainage Basins addresses all critical areas except geologically hazardous areas. For clarity, the name of the chapter should be revised to more clearly indicate that the chapter addresses critical areas.

The first section within Chapter 90, Introduction, includes overview provisions such as purpose and applicability that introduce the reader to the chapter as a whole. Considerations for revisions and additions to these provisions are discussed below, and a summary of this review is provided in the following table.

Table 2-1. Introduction section review summary

Section	Title	Review Comment / Recommendations
90.05	User Guide	None
90.10	Purpose	None
90.15	Applicability	• Consider removing or revising small wetlands exemption per BAS
90.20	General Exceptions	• Consider including provisions defining exemption request and review processes • Clarify definition of maintenance and repair • Require retroactive mitigation for emergencies • Consider developing additional provisions for allowed uses, including public access trails • Consider clarifying the prohibition on increases in impervious areas • Consider clarifying "expeditiously restored"
90.25	Sensitive Areas Maps and Other Resources	• Clarify role of maps relative to critical area regulations and review
90.30	Definitions	• Reduce redundancy and internal inconsistencies • Consider reorganizing for ease of use • Perform comprehensive review to ensure consistency with updated critical areas regulations

Section 90.15: Applicability

This section defines the applicability of Chapter 90. Under this section, smaller, lower-functioning wetlands are exempt from critical areas regulations. BAS indicates that even the smallest wetlands have value, and impacts to such wetlands should be mitigated to achieve no net loss of wetlands. However, if the City wishes to retain an exemption for small wetlands, Ecology recommends exempting only those isolated Category III and IV wetlands less than 1,000 square feet that are not associated with riparian areas or buffers, are not part of a wetland mosaic, and do not contain habitat identified by the Washington Department of Fish and Wildlife as essential for local populations of priority species (see Section 3 of this document for discussion of wetland categories) (Ecology 2012). Exempted wetlands would not be subject to buffer requirements or mitigation sequencing analysis, but impacts to exempted wetlands would still need to be compensated. (See discussion of wetland compensation measures under Section 3, below).

Section 90.20: General Exceptions

To better track and review exemptions, we recommend that this section be revised to define an exemption request and review process, in which the City reviews, grants or denies, and files exemptions. While exempt activities do not need to demonstrate mitigation sequencing, exemption should not be interpreted as permission to degrade a critical area or ignore risks from natural hazards. All exempt activities should use City-approved best management practices and other reasonable methods to minimize impacts to critical areas and their buffers. The City may require submittal of a critical area study if needed to assess public safety risks associated with an exempt activity.

Sections 90.20(1) and (2) are redundant with the wetland definition in 90.30. We recommend the City consider removing this section to streamline the code.

Section 90.20(4) allows utility work and roadway maintenance provided there is no increase in impervious areas. In implementation, this provision has occasionally led to the unnecessary installation of pervious sidewalks over impervious soils. To avoid this, the City should consider including a qualifier stipulating that impervious areas could be allowed where the underlying soils are shown by a qualified geotechnical engineer to be impervious (e.g. glacial till).

Section 90.20(6) exempts normal and routine maintenance or repair of structures, provided that such activities do not increase the footprint of a structure within a critical area or its buffer. We recommend that the City consider clarifying its definition of "normal and routine maintenance or repair of structures" in order to clarify that the exemption does not apply to significant or complete replacement, which should be required to undergo critical area review. These provisions should be reviewed and made consistent with KZC Chapter 162 (Nonconformances) and existing code interpretation(s).

Section 90.20(9) exempts emergency activities "necessary to prevent an immediate threat to public health, safety, or welfare." To minimize long-term impacts to critical areas, we

recommend that this section also require that after the emergency, the person or agency undertaking the action fully fund and conduct necessary restoration and/or mitigation for any impacts to critical areas or their buffers resulting from the emergency action, in accordance with an approved critical area report and mitigation plan. Additionally, the section should require demonstration of coordination or permits from state and federal regulatory agencies.

Finally, the City should consider including a list of allowed uses within critical areas (that are not exempt from regulations), and providing specific standards for those uses. Examples include passive recreation that does not significantly impact vegetation, public pedestrian access trails, minor site investigative work, or restoration of critical areas, subject to review by the planning official.

Section 90.25: Sensitive Areas Maps and Other Resources

As stated in this section, maps are intended to be used only as guides, and do not portray the authoritative, comprehensive locations and dimensions of critical areas within the city. We recommend revising the language in this section to be more explicit that the provisions within Chapter 90, and the findings of a critical area review pursuant to Chapter 90, take precedence over the City's critical area maps.

Section 90.30: Definitions

This section should be comprehensively revisited as the City's critical areas regulations are updated to ensure consistency with the GMA, BAS, City code, and other applicable sources. The following are general recommendations for updating the definitions section:

- Reduce redundancy and internal inconsistencies. Several of the existing definitions in this chapter duplicate terms found elsewhere in City code, or conflict with definitions elsewhere in the chapter. For example, the definition section includes both "critical areas" and "sensitive areas," with overlapping definitions. Other terms, such as "minor improvements" and "frequently flooded areas," have placeholders in Chapter 5 KZC, Definitions that point readers to either the SMP or critical areas chapters of the code. We recommend using one, but not both, of each of these consistently throughout City code.

- Reorganize definitions logically. For ease of use, consider grouping definitions with overlapping subject matter. For example, the definitions for Class A, B, and C streams are separate from the definition for streams. A similar approach is taken for wetlands.

3 WETLANDS

The wetlands section of the critical areas regulations should be updated to be more consistent with BAS. Notable recommendations include: updating the manual used for wetland identification and delineation, using the state wetland rating system, updating buffer width

requirements to align with BAS, and providing more detailed mitigation regulations. Table 3-1 summarizes recommendations, which are addressed in more detail below.

Table 3-1. Wetlands regulations section review summary

Section	Title	Review Comment / Recommendations	Comparison to SMP
90.35	Wetland Determinations, Delineations, Regulations, Criteria, and Procedures	• Update to reference federal manual and regional supplements	• Requires federal manual and regional supplements
90.40	Wetland Determinations	• Update "surrounding area" boundary • Reference latest version of rating system and consider "as amended" qualifier • Update duration of decision to 5 years	• Surrounding area boundary defined as within 250 feet of the subject property in all directions • Refers to 2004 wetland rating system, or as revised • Wetland delineations expire after 5 years
90.45	Wetland Buffers and Setbacks	• Update buffer width requirements • Revise provisions on stormwater facilities, water quality facilities, and minor improvements in wetland buffers • Consolidate provisions on permitted uses and modifications in wetland buffers	• Buffers based on wetland category and habitat score; widths range from 50-215 feet • Stormwater, water quality, minor improvement, and permitted use standards same as Chapter 90
90.50	Wetland Buffer Fence or Barrier	• Include additional specifications for signs and fencing • Remove hedges for consideration as a barrier • Move to general provisions section	• Same as Chapter 90
90.55	Wetland Modification	• Require mitigation sequencing • Require consistency with Ecology publication • Revise mitigation requirements for increased specificity and consistency with SMP • Consider use of mitigation banks and ILF programs	• Applicant must demonstrate mitigation sequencing • Requires consistency with Ecology publication • No provisions for off-site mitigation
90.60	Wetland Buffer Modification	• Revise buffer averaging and reduction provisions • Include optional impact-minimization measures for increased flexibility for applicants	• Buffer reduction with enhancement and buffer averaging limited to 25 percent standard buffer width • No inclusion of impact-minimization measures
90.65	Wetland Restoration	• Consolidate with wetland mitigation provisions	• Same as Chapter 90

Section	Title	Review Comment / Recommendations	Comparison to SMP
90.70	Wetland Access	• Include additional specifications for trails and other access features • Consolidate with other provisions on permitted uses and modifications in wetland buffers	• City may develop access at a public park to minimize environmental impacts

Section 90.35: Wetland Determinations, Delineations, Regulations, Criteria, and Procedures

Currently, the City requires that all wetland delineations be made using "…the criteria and procedures described in WAC 173-22-035, now or hereafter amended." While this provision is still valid, we recommend that, similar to the City's shoreline critical areas regulations (KZC 83.500(2)), this section further specify the requirements under WAC 173-22-035: "All determinations and delineations of wetlands shall be made using the criteria and procedures contained in the approved federal wetland delineation manual and applicable regional supplements."

Section 90.40: Wetland Determinations

This section requires that an initial site assessment determine whether any portion of the subject property or surrounding area meets the definition of a wetland. "Surrounding area" includes the area within 100 feet of the subject property. This number should reflect the largest possible standard wetland buffer width in order to fully encompass all areas that may be subject to impacts from development. Under the shoreline critical areas in the City's SMP, the "surrounding area" includes the area within 250 feet of the subject property. For consistency with recommended buffer widths and the SMP, we recommend revising the "surrounding area" in this section to include the area within 250 feet of the subject property.

The City of Kirkland currently ranks individual wetland functions and values using the Kirkland Wetland Field Data Form (Kirkland Zoning Code, Chapter 180, Plate 26). This form was developed in the 1990s at the same time that the Washington State Department of Ecology Wetland Rating System was being drafted and it contains many similar elements. The Kirkland Wetland Field Data Form classifies wetlands as one of three types based on specific site characteristics and landscape setting. Wetlands that are contiguous with Lake Washington are highly valued (Type 1) under the City's current wetland classification system.

For wetlands in shoreline jurisdiction, the City's SMP requires use of the Washington State Wetland Rating System for Western Washington – Revised (Ecology publication No. 04-06-025, or as revised). Ecology updated this rating system in June of 2014. The current BAS-based wetland rating system is the *Washington State Wetland Rating System for Western Washington* (Hruby 2014, Ecology publication No. 14-06-029). Using reference wetlands, Ecology calibrated the updated 2014 wetland rating system to maintain roughly the same distribution of wetland categories that were present under the prior 2004 rating system.

For consistency with BAS and the SMP, we recommend that the City update its wetland classification and rating provisions to require that wetlands be classified into category I, category II, category III, and category IV according to the Washington State Wetland Rating System for Western Washington (Ecology publication No. 14-06-029, or as revised and approved by Ecology). The City could also use this section to briefly summarize the criteria for each wetland class, as defined formally in Ecology publication 14-06-029.

Finally, subsection 90.40(4) requires that a wetland determination be reviewed for any development activity proposed on the subject property within two years of the determination. Generally, approved jurisdictional determinations and wetland delineations expire after five years. Accordingly, the SMP uses five years for this requirement. We recommend that this provision be updated for consistency with Corps and Ecology policies and the SMP.

Section 90.45: Wetland Buffers and Setbacks

BAS indicates that effective wetland buffer widths vary depending on the targeted wetland functions, intensity of surrounding land use, and buffer characteristics. Buffers should be generally be larger for wetlands with higher habitat scores and for wetlands adjacent to higher-intensity land uses. The City's existing standard buffer widths in subsection 90.45(1) are based on wetland category and whether the wetland is located in a primary or secondary drainage basin (see Table 3-2 below). These buffer widths are generally smaller than those recommended by Ecology to effectively protect wetland functions and values, as evidenced in Tables 3-2 and 3-3. In addition, if the City wants to retain its simplified buffer provisions based on its category and drainage basin approach, significantly larger buffers will be required to ensure protection under diverse conditions.

Since most uses in the City of Kirkland fall under either moderate-intensity (e.g. low-density residential, paved trails, parks) or high-intensity (high-density residential, commercial) accounting for land use intensity may not be particularly useful. Instead, the City should consider a simplified approach, which bases buffer widths on wetland rating and habitat scores. Table 3-3 shows standard buffer widths recommended by Ecology. The recommendations were developed by Ecology for small cities with limited funding and/or staff to develop BAS-based buffers; however, because the recommendations incorporate consideration of land use intensity, they are applicable more broadly to both larger cities and unincorporated rural areas. These buffer widths are based on wetland rating and habitat score (on a range of 3 to 9, with 9 representing high habitat function), and assume moderate-to-high land use intensity (Ecology 2012). Ecology updated these standard buffer widths to the new rating system in June of 2015.

The buffers presented in Table 3-3 are wide enough to allow for buffer reduction through enhancement, buffer averaging, or implementation of optional impact-minimization measures (see discussion under section 90.60, Wetland Buffer Modification, below). This approach allows flexibility to accommodate site constraints or other existing conditions while still ensuring adequate protection of wetland functions and values.

Alternatively, the City could reduce all of the standard buffers in Table 3-3 by 25 percent, resulting in required buffers that range between approximately 40 to 225 feet (rather than 50 to 300) feet. Under this approach, buffers would be required to be fully functioning, meaning that any development that would increase impacts to the area adjacent to the buffer would be required to revegetate the buffer area (if degraded). This approach would not allow for the potential for any buffer reduction. This approach could also result in the need for additional planning review of buffer composition, functions, and monitoring.

Table 3-2. Standard wetland buffer widths in current City code

Wetland type	Buffer width for wetlands in primary basin (feet)	Buffer width for wetlands in secondary basin (feet)
1	100	75
2	75	50
3	50	25

Table 3-3. BAS-based standard buffer widths (Ecology 2015)

Wetland Category and Type[1]	Buffer width (in feet) based on habitat score (3-9)			
	3-4	5	6-7	8-9
I: Bogs and wetlands of high conservation value	250			300
I: All others	100	140	220	300
II	100	140	220	300
III	80	140	220	300
IV	55			

1 Wetland categories based on the Western Washington Wetland Rating System (Ecology publication #14-06-029). Note that Ecology provides additional buffer recommendations for estuarine wetlands; these are not included in Table 3-3 due to a lack of marine shorelines in the city.

The City's shoreline critical areas regulations in the SMP (KZC 83.500(4)) adopt standard buffer widths based on habitat score for wetlands in shoreline jurisdiction (Table 3-4). These buffers are similar in width to the minimum buffer widths recommended by Ecology (Ecology 2012). Although the City's SMP references the 2004 wetland rating system, as amended (see above), the 2014 update significantly changed the way the scoring system for wetland functions; therefore, the habitat scores referenced in the SMP no longer correlate to the updated wetland rating system. Ecology has developed conversion tables for category scores between the 2004 and 2014 rating systems, which should be applied to shoreline critical areas until the City updates its SMP.

Table 3-4. Standard wetland buffer widths in the City's SMP

Wetland Category and Type[1]	Buffer width (in feet) based on habitat score		
	Less than 20	20-28	29-36
I: Bogs and wetlands of high conservation value	215		
I: All others	125	150	215
II	100	125	200
III	75	125	NA
IV	50		

1 Wetland categories based on the Western Washington Wetland Rating System (Ecology

Sections 90.45(3) and (4) also include provisions allowing stormwater outfalls and water quality facilities within wetland buffers under certain conditions. Ecology recommends limiting stormwater management facilities to dispersion outfalls and bioswales within the outer 25 percent of the buffer of Category III or IV wetlands, and then only when no other location is feasible and the facilities will not degrade wetland functions and values (Ecology 2012). We recommend that the City revise its regulations related to stormwater and water quality facilities in wetlands and wetland buffers to be consistent with this Ecology guidance.

Section 90.45(5) includes provisions allowing minor improvements within wetland buffers under certain conditions. This section should be revised to add guidance for types of minor improvements that may be permitted.

Finally, we recommend that the three sections described above be consolidated with those provisions in Section 90.60, Wetland Buffer Modification, in order to increase clarity regarding uses and modifications permitted in wetland buffers.

Section 90.50: Wetland Buffer Fence or Barrier

This section requires installation of both a temporary construction fence and, upon project completion, a permanent fence around the wetland and its buffer. To better align with BAS, this section should provide additional standards for permanent signs and fencing. Signs should be posted that identify the wetland area, and fencing should be designed so as to not interfere with species migration and to minimize impacts to the wetland. We recommend that these provisions be moved into a section containing general provisions which apply to all critical areas. Furthermore, the allowance of an "equivalent barrier" in lieu of a fence has proven problematic, especially when hedges are proposed. If the City wishes to retain this allowance, it should develop specific standards for hedge type, spacing, and maintenance over time in order to ensure equal protection.

Section 90.55: Wetland Modification

This section includes provisions that limit modifications to wetlands. These provisions allow up to a certain percentage of the wetland to be modified, depending on the wetland type and drainage basin. For all modifications, compensatory mitigation must be provided in order to achieve the goal of no net loss of wetland function, value, and acreage (KZC 90.55(4)). To better align with BAS, the City should consider requiring mitigation sequencing for all projects rather than establishing set limits on the percentage of wetland area that can be modified. Mitigation sequencing directs an applicant to take the following actions when designing a project, listed in order of preference: avoid the impact; minimize the impact; rectify the impact through repair, rehabilitation, or restoration; reduce or eliminate the impact over time; and compensate for the impact through replacement or substitution. Compensation is inherently more risky than avoidance or minimization because replicating or restoring self-sustaining physical, chemical, and biological wetland characteristics is a complex, uncertain undertaking that can require

years to achieve desired results. For this reason, applicants should complete a mitigation sequencing analysis, and compensation should be the last resort. The City's SMP includes provisions that require mitigation sequencing for land surface modification or development permits within critical areas (KZC 83.490(2)(a)).

Section 90.55(4) also includes mitigation ratios for compensatory wetland mitigation. These provisions generally align with state guidance, but should include more specificity. In particular, the wetland mitigation ratios in the City's current regulations are similar to those recommended by Ecology guidance based on BAS, but only for wetland creation or reestablishment. Table 3-5 shows wetland mitigation ratios required in the City's SMP. These ratios are generally consistent with current Ecology guidance and present more flexibility for wetland mitigation than the ratios in Chapter 90 (KZC 83.500(8)).

Table 3-5. Compensatory wetland mitigation ratios from City of Kirkland SMP

Category and Type of Wetland Impacts	Re-establishment or Creation	Re-habilitation Only	Re-establishment or Creation (R/C) and Rehabilitation (RH)	Re-establishment or Creation (R/C) and Enhancement (E)	Enhancement Only
Category I Bog or Natural Heritage Site	Not allowed	6:1 Rehabilitation of a bog	Not allowed	Not allowed	Case by case
Category I – based on score for functions	4:1	8:1	1:1 R/C and 6:1 RH	1:1 R/C and 12:1 E	16:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 RH	1:1 R/C and 20:1 E	24:1
Category II	3:1	6:1	1:1 R/C and 4:1 RH	1:1 R/C and 8:1 E	12:1
Category III	2:1	4:1	1:1 R/C and 2:1 RH	1:1 R/C and 4:1 E	8:1
Category IV	1.5:1	3:1	1:1 R/C and 1:1 RH	1:1 R/C and 2:1 E	6:1

For greater flexibility, the City may wish to consider allowing a credit-debit analysis to be applied to individual projects. The Credit-Debit method is a tool "for estimating whether a plan for compensatory mitigation will adequately replace the functions and values lost when a wetland is altered. The tool is designed to provide guidance for both regulators and applicants during two stages of the mitigation process: 1) estimating the functions and values lost when a wetland is altered, and 2) estimating the gain in functions and values that result for the mitigation" (Hruby 2012). Ecology issued the tool in 2012 before the current 2014 wetland rating system was completed. As a result, use of the credit-debit method effectively requires two separate wetland ratings: one for buffer determination, with the 2014 rating system; and one for

credit-debit calculation, with the credit-debit method rating system. While the option to use the credit-debit method is based on a wetland functions analysis and provides more flexibility for applicants, the method is inherently more complex than use of mitigation ratios.

At present, the credit-debit method is used primarily for calculating credits for mitigation banks and in-lieu fee programs, such as the King County Mitigation Reserves Program. The City should consider allowing the use of the credit-debit method to enable use of mitigation banks and in lieu fee programs. Mitigation banks and in-lieu fee programs provide flexibility for compensatory mitigation. The potential advantages and disadvantages to allowing for the use of mitigation bank and in-lieu fee credits are discussed in Part A of this report. Certified wetland mitigation banks and in-lieu fee programs available for use by City residents are also discussed in Part A. Under current Chapter 90, wetland mitigation must be within the same drainage basin as wetland impacts. To make use of mitigation banking and in-lieu fee programs, the City would likely need to relax this restriction.

Off-site mitigation, including the use of mitigation banks or in-lieu fee programs, in general should be considered as an option where on-site mitigation is demonstrated to be infeasible or less likely to provide equal or improved wetland functions. Allowing for off-site mitigation may be particularly useful in the case of reasonable use exceptions, where on-site mitigation is often not feasible.

Finally, Ecology recommends that compensatory mitigation plans for wetland mitigation be consistent with *Wetland Mitigation in Washington State – Part 2: Developing Mitigation Plans – Version 1* (Ecology Publication No. 06-06-011b, or as revised).

Section 90.60: Wetland Buffer Modification

This section includes provisions for buffer reduction, which is allowed either through averaging or through reduction with enhancement. These provisions allow buffer reduction (either through averaging or enhancement) of up to 33 percent at any given point of the buffer. In order to ensure adequate buffer functions, Ecology recommends limiting buffer reduction to 25 percent of standard buffer widths.

As noted above, the standard buffer widths presented in Table 3-3, above, were developed based on BAS for use in small cities, where land use intensity, and associated wetland impacts, are generally moderate to high. As noted above, the recommendations were developed to reduce the planning burden on small cities, but because they incorporate consideration of land use intensity, their applicability extends to large cities, as well as unincorporated rural areas. These buffer widths allow for buffer reduction of up to 25 percent with enhancement. Additionally, required buffer widths may be reduced for those projects that can mitigate the impacts and disturbances associated with surrounding land use. Table 3-6 lists impact-minimization measures that, when implemented where applicable, may allow an applicant to reduce the standard buffer widths in Table 3-3 by up to 25 percent (Ecology 2012). This approach provides flexibility for applicants while resulting in higher-functioning buffers that

are sensitive to existing wetland function. We recommend that the City update its buffer provisions to adopt the new BAS-based buffer widths in Table 3-3 together with the optional impact-minimization measures in Table 3-6.

Table 3-6. Incentive measures to reduce buffer widths and minimize impacts to wetlands

Disturbance	Required Measures to Minimize Impacts
Lights	• Direct lights away from wetland
Noise	• Locate outdoor activity that generates noise away from wetland • If warranted, enhance existing buffer with native vegetation plantings adjacent to noise source
Toxic runoff	• Route all new, untreated runoff away from wetland while ensuring wetland is not dewatered • Establish covenants limiting use of pesticides within 150 feet of wetland • Apply integrated pest management
Stormwater runoff	• Retrofit stormwater detention and treatment for roads and existing development adjacent to the site • Prevent channelized flow from lawns that directly enters the buffer • Use Low Intensity Development techniques (per PSAT publication on LID techniques)
Change in water regime	• Infiltrate or treat, detain, and disperse into buffer new runoff from impervious surfaces and new lawns
Pets and human disturbance	• Use fencing OR plant dense vegetation to delineate buffer edge and to discourage disturbance using vegetation appropriate for the ecoregion • Place wetland and its buffer in a separate tract or protect with a conservation easement
Dust	• Use best management practices to control dust
Disruption of corridors or connections	• Maintain connections to offsite areas that are undisturbed • Restore corridors or connections to offsite habitats by replanting

Finally, the City could provide additional flexibility for applicants by allowing buffer reduction for buffers interrupted and hydrologically disconnected by transportation corridors such as roadways or the Cross Kirkland Corridor. The City's SMP provides appropriate consideration of these circumstances.

Section 90.65: Wetland Restoration

To clarify when and how this section is implemented, we recommend that the City consolidate or merge this section with wetland mitigation provisions (Section 90.55).

Section 90.70: Wetland Access

This section of Chapter 90 allows for the City to develop access through a wetland and its buffer in conjunction with a public park. Ecology guidance does allow for walkways, trails, and wildlife viewing structures within wetland buffers. However, these uses should be limited in size (Ecology recommends no wider than five feet), located within the outer 25 percent of the wetland buffer area, and constructed of pervious materials. These specifications are more

detailed than what is provided in the City's critical areas regulations and SMP. The City should consider incorporating these more detailed provisions to regulate access through wetland buffers. The City may provide additional allowances for trails through wetlands and wetland buffers when necessary for pedestrian access to small lakes or stream crossings, provided that such uses minimize wetland and wetland buffer impacts. We also recommend consolidating wetland access provisions from this section with other wetland buffer modification provisions (Section 90.60).

4 MINOR LAKES

This section states that "the majority, if not the entirety, of the perimeters of Totem Lake and Forbes Lake meet the definition of wetlands." Accordingly, the shallow portions of these lakes are subject to the wetlands regulations of Sections 90.35 through 90.70.

Section 90.75 defines additional regulations regarding modifications to the deep water portions of the lake, including maintenance, moorage structures, and bulkheads. The City should consider whether new moorage structures and piers on these small lakes should continue to be permitted. Deep water areas would be regulated together with streams and other non-shoreline watercourses pursuant to WAC 365-190-130, and the City should consider including this section in a new Fish and Wildlife Habitat Conservation Areas section (see Section 5 of this document, below).

5 STREAMS (INCLUDING FISH AND WILDLIFE)

Stream regulations should be updated to improve protection and align with current BAS. Considerations for updates to stream designation, classification, and protection standards in current City code are discussed below, and a summary of this review is provided in the following table. Table 5-1 provides an overview of issues, which are discussed in greater detail below.

Table 5-1. Streams regulations section review summary

Section	Title	Review Comment / Recommendations	Comparison to SMP
All	Streams	• Consider moving to new "Fish and Wildlife Habitat Conservation Areas" section • Add provisions for endangered, threatened, and sensitive species • Consider whether to designate locally important species or habitats	• Same as Chapter 90

Section	Title	Review Comment / Recommendations	Comparison to SMP
90.80	Activities in or Near Streams	• Consider removing	• Same as Chapter 90
90.85	Stream Determinations	None	• Same as Chapter 90
90.90	Stream Buffers and Setbacks	• Update stream classification to use Permanent Water Typing System (WAC 222-16-030) • Update buffer width requirements • Revise provisions on stormwater facilities for clarity • Include provisions for access to waterbody • Consolidate provisions on permitted uses and modifications in stream buffers	• Permanent Water Typing System used for shoreline areas in RSA and RMA zones and O.O. Denny Park • Separate buffer widths for the above areas; general stream buffers same as Chapter 90 • Stormwater provisions same as Chapter 90
90.95	Stream Buffer Fence or Barrier	• Include additional specifications for signs and fencing • Move to general provisions section • Remove hedges for consideration as a barrier	• Same as Chapter 90
90.100	Stream Buffer Modification	• Limit buffer reduction with enhancement to 25% of standard buffer width • Require minimum buffer width of 25 feet at any point	• Same as Chapter 90 • Same as Chapter 90
90.105	Stream Relocation or Modification	• Consider additional flexibility for stream restoration and daylighting • Consider additional mitigation requirements for streams	• Same as Chapter 90
90.110	Bulkheads in Streams	• Add requirements for HPA and use of design guidelines • Consolidate with other stream modification provisions	• Requires HPA and 2003 WDFW design guidelines
90.115	Culverts in Streams	• Revise provisions to consider bridges and	• Culvert proposals allowed only if bridge is infeasible • More general title: “Stream Crossings”; requires HPA and use of 2003 WDFW design guidelines

Section	Title	Review Comment / Recommendations	Comparison to SMP
		bottomless culverts before pipe-style culverts • Add requirements for use of design guidelines • Include provisions for access to culvert/bridge through buffer • Consolidate with other stream modification provisions	
90.120	Stream Rehabilitation	• Clarify intent • Encourage stream daylighting	• Same as Chapter 90

Streams (Sections 90.80 – 90.120)

Under the GMA, jurisdictions are directed to include provisions that address land use issues that directly and indirectly impact fish and wildlife habitat. The designation of such areas should include areas with which endangered, threatened, sensitive, and locally important species have a primary association; certain aquatic habitats; waters of the state; state natural area preserves and natural resource conservation areas; and areas critical for habitat connectivity (WAC 365-190-130).

Current City code includes provisions that protect minor lakes and streams. To better align with state guidance, the City should consider consolidating its provisions for minor lakes and streams into a new Fish and Wildlife Habitat Conservation Area section, and expanding that section to address other habitats important to endangered, threatened, and sensitive species. Alternatively, the City could maintain separate sections for streams (together with minor lakes) and terrestrial species and habitats.

Presently, bald eagle and pileated woodpecker are the only non-salmonid species listed as sensitive. Because species distributions and state and federal designations can change, in addition to or in place of listing these species in the code, the City should consider stating that any state or federal endangered, threatened, or sensitive species shall be managed per state or federal recommendations. The Washington Department of Fish and Wildlife develops management recommendations for the state's priority habitats and species. Standards from these management recommendations can be incorporated into local regulations or referenced. Because the State of Washington no longer provides management recommendations for State-sensitive bald eagles, management provisions for bald eagles should be explicitly included in local regulations. A detailed discussion of species and habitats relevant to the City of Kirkland is provided in Part A of this report.

Whereas the City is required to adopt regulations to protect State or federally listed endangered, threatened, and sensitive species, it has the option to identify habitats and species of local importance. Rather than designate new species or habitats of local importance during

the critical areas regulatory update, several other jurisdictions have opted to establish nomination criteria in their critical areas provisions to facilitate potential future designation of these species and habitats.

Section 90.80 Activities in or near Streams

The provision in this section, which prohibits land surface modification and tree removal in streams and stream buffers, is identical to the first provision of Section 90.90, Stream Buffers and Setbacks. We recommend removing this section in order to eliminate redundancy and avoid confusion.

Section 90.90: Stream Buffers and Setbacks

The stream classification system and associated buffer widths that apply to most of the city under current City code are presented in Table 5-2 below. Class A streams are used by salmonids and generally correlate with Type F streams as defined in WAC 222-16-030. Class B and C streams are not used by salmonids and generally correlate with Type Np and Type Ns streams, respectively, as defined in WAC 222-16-030.

Table 5-2. Stream class and buffer widths under current City code

Stream Class	Buffer width for streams in primary basin (feet)	Buffer width for streams in secondary basin (feet)
A	75	N/A
B	60	50
C	35	25

For streams in shoreline jurisdiction within the single-family residential (RSA) and multi-family residential (RMA) zones and O.O. Denny Park, the SMP defines a different stream classification system (KZC 83.510), which is derived from the Department of Natural Resource (DNR) Permanent Water Typing System (WAC 222-16-030). To standardize stream classifications across the state, DNR recommends adopting the Permanent Water Typing System, which is more descriptive and inclusive than the stream classification defined in current Chapter 90. The primary difference between the current and recommended stream classification systems is that the recommended system considers all fish use, not just salmonids. Table 5-3 below describes the Permanent Water Typing System.

Table 5-3. Permanent Water Typing System (WAC 222-16-030)

Permanent Water Typing	Brief Description	Full Description
Type S	Shoreline of the State	All waters, within their bankfull width[1] as inventoried as "shorelines of the state" under chapter 90.58 RCW and the rules promulgated pursuant to chapter 90.58 RCW including periodically inundated areas of their associated wetlands.
Type F	Fish bearing stream (may be perennial or seasonal)	Segments of natural waters other than Type S Waters, which are within the bankfull widths of defined channels and periodically inundated areas of their associated wetlands, or within lakes, ponds, or impoundments having a surface area of 0.5 acre or greater at seasonal low water and which in any case contain fish habitat or are

Permanent Water Typing	Brief Description	Full Description
		described by one of the following four categories: (a) Waters, which are diverted for domestic use by more than 10 residential or camping units or by a public accommodation facility licensed to serve more than 10 persons, where such diversion is determined by the department to be a valid appropriation of water and the only practical water source for such users. Such waters shall be considered to be Type F Water upstream from the point of such diversion for 1,500 feet or until the drainage area is reduced by 50 percent, whichever is less; (b) Waters, which are diverted for use by federal, state, tribal or private fish hatcheries. Such waters shall be considered Type F Water upstream from the point of diversion for 1,500 feet, including tributaries if highly significant for protection of downstream water quality. The department may allow additional harvest beyond the requirements of Type F Water designation provided the department determines after a landowner-requested on-site assessment by the department of fish and wildlife, department of ecology, the affected tribes and interested parties that: (i) The management practices proposed by the landowner will adequately protect water quality for the fish hatchery; and (ii) Such additional harvest meets the requirements of the water type designation that would apply in the absence of the hatchery; (c) Waters, which are within a federal, state, local, or private campground having more than 10 camping units: Provided, That the water shall not be considered to enter a campground until it reaches the boundary of the park lands available for public use and comes within 100 feet of a camping unit, trail or other park improvement; (d) Riverine ponds, wall-based channels, and other channel features that are used by fish for off-channel habitat. These areas are critical to the maintenance of optimum survival of fish. This habitat shall be identified based on the following criteria: (i) The site must be connected to a fish habitat stream and accessible during some period of the year; and (ii) The off-channel water must be accessible to fish.
Type Np	Non-fish bearing perennial stream	All segments of natural waters within the bankfull width of defined channels that are perennial nonfish habitat streams. Perennial streams are flowing waters that do not go dry any time of a year of normal rainfall and include the intermittent dry portions of the perennial channel below the uppermost point of perennial flow.
Type Ns	Non-fish bearing seasonal stream	All segments of natural waters within the bankfull width of the defined channels that are not Type S, F, or Np Waters. These are seasonal, nonfish habitat streams in which surface flow is not present for at least some portion of a year of normal rainfall and are not located downstream from any stream reach that is a Type Np Water. Ns Waters must be physically connected by an above-ground channel system to Type S, F, or Np Waters.

1 “Bankfull width” corresponds with the start of the floodplain receiving floodwaters in most years and characterized by two or more of the following: a change in the topography from a bank to a flat valley or bench, a change in vegetation from bare surface to water tolerant or upland species, and a change in sediment texture from gravel to fine sand (Pleus and Schuett-Hanes 1998).

Under current City code, stream buffer widths vary depending on whether the stream is located in a primary or secondary basin. As discussed in Part A of this report, a wide range of stream buffer widths are recommended depending on the target functions and buffer condition. Soils, slope, buffer continuity and vegetative quality are important factors in determining buffer effectiveness. Standard stream buffer requirements under current City code are generally lower than the range of buffer widths supported by BAS. Stream buffer widths in the SMP that are applicable to the RSA and RMA zones and O.O. Denny Park are within the range supported by BAS.

Table 5-4 below provides a summary of buffer width ranges supported by BAS and similar to other local jurisdictions in the Puget Sound area. In deciding on standard buffer widths, the City should consider the degree to which flexibility is important for City applicants. In general, wider standard buffers will provide for more opportunity for flexibility through buffer reduction and averaging. The City may also choose to consider whether certain riparian buffer functions are more important to protect for the city's streams. Table 3-3 of Part A of this report lists the range of effective buffer widths for different riparian functions.

Table 5-4. Appropriate buffer ranges by stream type per BAS

Stream Type	Sample Buffer Ranges
S	115 - 165 feet
F	100 - 165 feet
Np	50 - 65 feet
Ns	50 - 65 feet

Sections 90.90(3) and (4) also include provisions allowing stormwater outfalls and water quality facilities within stream buffers under certain conditions. These provisions require that stormwater be discharged at the surface through stream buffers unless such discharge would clearly pose a threat to slope stability, water quality, or fish and wildlife. These provisions generally align with BAS, which recommends that buffers be used to intercept runoff and provide biofiltration functions where possible. We recommend that these provisions be revised to explicitly allow discharge within the buffer, as far from the stream as feasible, when necessary to allow gravity flow to a receiving water from a detention facility.

Section 90.45(5) includes provisions allowing minor improvements within stream buffers under certain conditions. This section should be revised to add guidance for types of minor improvements that may be permitted, such as trails. As for trails in wetland buffers, revisions should include standards for maximum trail size, location, and materials. The City may provide additional allowances for trails through stream buffers when necessary for pedestrian access, provided that such uses minimize stream and stream buffer impacts.

Finally, we recommend that the three sections described above be consolidated with those provisions in Section 90.100, Stream Buffer Modification, in order to increase clarity regarding uses and modifications permitted in stream buffers.

Section 90.95: Stream Buffer Fence or Barrier

This section requires installation of both a temporary construction fence and, upon project completion, a permanent fence around the stream and its buffer. To better align with BAS, this section should provide additional standards for permanent signs and fencing. Signs should be posted that identify the stream and buffer, and fencing should be designed so as to not interfere with species migration and to minimize impacts to the stream and its buffer. We recommend that these provisions be moved into a section containing general provisions which apply to all critical areas.

Also, as with wetland buffers, the allowance of an "equivalent barrier" in lieu of a fence has proven problematic, especially when hedges are proposed. If the City wishes to retain this allowance, it should develop specific standards for hedge type, spacing, and maintenance over time in order to ensure equal protection.

Section 90.100: Stream Buffer Modification

Under this section of current City code, stream buffers may be reduced through buffer averaging or through reduction with enhancement, but may not be reduced at any point by more than one-third of the standard buffer width. The acceptable percent reduction will depend on the width of standard buffers proposed, and should be further limited if the buffer is located on a steep slope. Buffer reduction with enhancement should only be applied in cases where the existing buffer is degraded and can therefore benefit from enhancement. A maximum reduction of 25 percent of the standard buffer width is commonly applied in other jurisdictions, and is applied in the City's SMP to shoreline areas in the RSA and RMA zones and O.O. Denny Park. As described above, the City may choose to define narrower standard buffers with limited reduction options or wider standard buffers with increased buffer reduction allowances; however, to ensure a functional buffer, the buffer should never be narrower than 25 feet at any point.

Section 90.105: Stream Relocation or Modification

This section includes provisions for stream relocation or modification, which is only permitted if stream functions will be significantly improved by the relocation or modification. The section effectively addresses stream restoration, and the City should consider including additional flexibility for stream restoration projects which relocate and/or daylight a stream channel. For example, the City could reduce buffer requirements for daylighted streams, particularly when constrained by adjacent properties. The City could also allow additional flexibility for buffer averaging or reduction to facilitate meandering of restored stream channels within existing vegetated corridors.

Although this section states that only those modifications which improve stream functions are permitted, other code sections provide allowances for bulkheads, culverts, trails, outfalls, water quality facilities, and other minor improvements in streams and stream buffers. In order to protect stream functions while still allowing these improvements, we recommend adding

mitigation requirements for stream and stream buffer modification projects, including specifications for mitigation sequencing and mitigation plans specific to streams.

Section 90.110: Bulkheads in Streams

The City's regulations in this section prohibit armoring in streams unless they are proven necessary to prevent against erosion. These provisions prohibit armoring when it results in adverse stream impacts. We recommend that bulkhead projects follow mitigation sequencing requirements to avoid, minimize, and compensate for adverse impacts. This will add flexibility in cases where bulkheads are necessary, while providing a framework for addressing unavoidable impacts.

We also recommend referring to the need for new streambank stabilization projects to obtain a Hydraulic Project Approval (HPA) and Section 404 permit, and for such projects to be designed consistent with the Washington Department of Fish and Wildlife's design guidelines for streambank stabilization. This approach is consistent with the City's SMP.

Section 90.115: Culverts in Streams

The City's regulations in this section prohibit culverts in streams unless they are proven necessary to provide required access. As for streambank stabilization projects, we recommend that culvert projects follow mitigation sequencing requirements to avoid, minimize, and compensate for adverse impacts in such cases when culverts are necessary.

As for streambank stabilization projects, we recommend referring to the need for new culvert projects to obtain a Hydraulic Project Approval, and for such projects to be designed consistent with the Washington Department of Fish and Wildlife's design guidelines for fish passage projects. The City should also consider requiring consideration of the use of a bridge or bottomless culvert as a preferred option over a traditional pipe-style culvert.

Section 90.120: Stream Rehabilitation

To clarify when and how this section is implemented, we recommend that the City add language to this section that explains its intent. For example, provisions could be added to explain under what circumstances stream rehabilitation would be required by the City. The City should also consider encouraging or requiring daylighting of streams where feasible, and where water quality and habitat conditions would be improved.

6 GENERAL

This section includes provisions that apply generally to all critical areas in the city. These regulations should be updated to improve protection and align with current BAS. Considerations for revisions and additions to general provisions in current City code are discussed below, and a summary of this review is provided in the following table.

Table 6-1. General section review summary

Section	Title	Review Comment / Recommendations
90.125	Frequently Flooded Areas	• Define the relationship between frequently flooded areas and areas of special flood hazard • Revise to incorporate protection of functions and values
90.130	Site Requirements and Sensitive Areas Protection Techniques	• Consider adding general mitigation sequencing requirements • Consider additional general protective requirements
90.135	Maximum Development Potential	• Revise to clarify relationship to other density requirements in City code • Evaluate past performance • Assess impact of wider buffers
90.140	Reasonable Use Exception	• Consider including compensation option
90.145	Bond or Performance Security	• Consider raising the mitigation bond rate to motivate owner compliance • Revise language to ensure that monitoring is covered under required bonds • Consider developing bond quantity worksheet
90.150	Dedication	None
90.155	Liability	None
90.160	Appeals	• Consider adding general administrative provisions to clarify review process
90.165	Setbacks and Buffers Required by Prior Approvals	• Revise to better reflect intent • Include provisions for nonconforming uses and structures
90.170	Planning/Public Works Official Decisions- Lapse of Approval	None

Section 90.125: Frequently Flooded Areas

This section refers to Kirkland Municipal Code (KMC) Chapter 21.56, Flood Damage Prevention, for all development in frequently flooded areas. Regulatory actions to prevent flood hazards include elevation above grade and prohibition of development in the floodway. The chapter also requires a habitat assessment for development within special flood hazard areas, consistent with the 2008 FEMA Biological Opinion (KMC 21.56.055). This flood hazard management approach is consistent with BAS findings on this topic. We recommend that the term "frequently flooded areas" be defined in this section in order to make a direct connection between such areas and the "areas of special flood hazard" identified in the City's Flood Damage Prevention code (KMC 21.56).

Within the City's critical areas regulations, KZC 90.10(4.) lists the major functions of frequently flooded areas, including storage and conveyance of flood waters, as well as provision of fish and wildlife habitat. The section states that the purpose of frequently flooded areas regulations is to "regulate development in the 100-year floodplain to avoid substantial risk and damage to public and private property." Under the GMA, regulations of frequently flooded areas exist not

only to reduce flood risk, but also to protect the functions and values of floodplains. We recommend revising the existing purpose statement to reflect this dual purpose.

Section 90.130: Site Requirements and Sensitive Areas Protection Techniques

This section includes general protective actions that may be required of an applicant to limit or avoid impacts to critical areas. In addition, the section requires that applicants "locate all improvements to minimize adverse impacts to sensitive areas." To better align with BAS, we recommend that the City consider revising these provisions to require that applicants demonstrate mitigation sequencing before permit approval is granted. As discussed in Section 4 of this gap analysis, the City's SMP includes provisions that require mitigation sequencing for all land surface modification or development permits within critical areas (KZC 83.490(2)(a)).

In addition to mitigation sequencing provisions, the City should consider other general protective provisions, including:

- General buffer provisions. A general buffer section could be used to define the purpose of critical area buffers as well as vegetation management provisions and allowed/prohibited use provisions that would apply to all critical area buffers.

- General setback provisions. Current Chapter 90 requires a 10-foot setback from wetlands and stream buffers. These requirements could be consolidated into a section containing general setback provisions, which could be expanded to include clear provisions on permitted uses and modifications in setbacks. In general, setbacks should serve to allow access for maintenance and repair without disturbing buffer areas. Appropriate uses could include landscaping, bay windows, and impervious ground surfaces such as driveways and patios, provided that such improvements are subject to the City's water quality regulations for stormwater management.

- Critical areas report. We recommend including regulations that clearly describe the purpose and required contents of a critical area report. Report requirements are found in various locations throughout the existing critical areas regulations. As such, their contents and applicability are not clearly conveyed. The Department of Commerce suggests that critical area report provisions require that the reports be prepared by a qualified professional; incorporate best available science; and include key information such as site plans, analysis of site development alternatives, and demonstration of mitigation sequencing.

Section 90.135: Maximum Development Potential

This section is used to calculate the base density allowed for properties that contain a wetland, stream, or minor lake, or their buffers. We recommend that the language in this section be revised to clarify its purpose as well as its relationship with Chapter 22.28 KMC, Design Requirements, and the density and dimensional requirements found in Chapter 15.30 KZC. The City should also consider evaluating whether the formula defined in this section has produced

desired outcomes in implementation since its adoption, and revise accordingly. Finally, the City should assess the impact of the potentially expanded stream and wetland buffers on existing density and dimensional requirements, and if necessary should consider adjusting the maximum development potential formula so that there is not a reduction in permitted density as a result of the wider buffer standards.

Section 90.140: Reasonable Use Exception

This section provides the City with a mechanism to approve limited uses within critical areas and critical area buffers when application of the City's critical areas regulations would deny all reasonable economic use of a property. The City should consider adding provisions to explicitly allow for the use of off-site compensatory mitigation to offset impacts associated with development authorized by Reasonable Use Exceptions.

Section 90.145: Bond or Performance Security

Under current City code, a performance bond is required to ensure compliance with applicable critical areas regulations. The amount of the bond, set at 125 percent of the estimated completion cost, is a standard amount recommended in state guidance. However, the City should evaluate overall compliance with critical areas regulations and determine whether an increased rate is justified to further motivate compliance. In addition, the City should consider amending the language in this section to include monitoring as a required component when estimating bond quantities, if monitoring will not be handled through payment to the City. The City could also allow for reduced bond amounts for bonds that include both maintenance and monitoring. Finally, the City should consider developing a bond quantity worksheet specific to City conditions. This would give the City more clarity and control over its approach to bonding.

Section 90.160: Appeals

Both Chapter 85 and Chapter 90 of the City's existing code contain sections on appeals, bonds, dedication, and liability. The City should consider how the code can be made clearer regarding process and decision authority for the various critical area administrative and discretionary approvals.

Section 90.165: Setbacks and Buffers Required by Prior Approvals

The City should consider revising this section to provide clarity of intent, and to provide further guidance for nonconforming uses and structures. In general, nonconforming uses and structures can be allowed to expand, provided their expansion does not increase the degree of nonconformity. For example, structures within a critical area buffer could be allowed to expand in the direction away from the buffer. The City could also allow such structures to expand laterally, or could set a threshold for lateral expansion. Nonconforming structures destroyed by fire or other casualty could be replaced pursuant to the nonconformance provisions in Chapter 162 of the KZC. Whether or not the City develops nonconformance provisions specific to critical areas, this section of Chapter 90 should include a reference to Chapter 162 of the KZC.

7 Tree Management and Required Landscaping (Chapter 95)

Chapter 95 of City code contains standards for tree management and required landscaping. The City's critical areas regulations refer to subsections of Chapter 95 where they apply in critical areas and critical area buffers. The subsections themselves align with BAS. To enhance usability, we recommend that the City move these subsections (those that apply in critical areas and critical area buffers only) into Chapter 90. The City should consider making them a part of a new section that contains general vegetation management provisions and that applies to all critical areas and critical area buffers. Additional vegetation management provisions could include specific tree replacement ratios and standards, and allowances for minor, nondestructive pruning. This approach would be consistent with the City's SMP, which includes similar provisions for tree and vegetation retention and replacement in shoreline jurisdiction (KZC 83.400).

8 Critical Aquifer Recharge Areas

An aquifer recharge area is an area where water from rainfall, snowmelt, lakes, rivers, streams, or wetlands flows into the ground to an aquifer. Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge.

To protect CARAs, recommended BAS-based protection measures include identifying and categorizing CARAs, identifying potential sources of contamination, assessing vulnerability of water resources, imposing protections, and managing CARA withdrawals. The current City of Kirkland regulations include "areas with a critical recharging effect on aquifers used for potable water" in the definition of critical areas (KZC 90.30(7)). However, due to a lack of these areas within the city, the code does not include critical area provisions specific to aquifer recharge areas, and inclusion is not warranted.

9 References

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10 ACRONYMS AND ABBREVIATIONS

BAS.....Best Available Science
CAO .....Critical Areas Ordinance
CARA.....Critical aquifer recharge areas
City.....City of Kirkland
DNR .....Department of Natural Resource
Ecology .....Washington State Department of Ecology
E .....Enhancement
FEMA.....Federal Emergency Management Agency
GMA.....Growth Management Act
HPA.....Hydraulic Project Approval
KZC.....Kirkland Zoning Code
LID.....Low Impact Development
PSAT .....Puget Sound Action Team
R/C.....Re-creation
RCW.....Revised Code of Washington
RH .....Rehabilitation
RMA.....Multi-Family Residential
RSA.....Single Family Residential
SMP .....Shoreline Master Program
State.....Washington State
WAC.....Washington Administrative Code
WDFW .....Washington Department of Fish and Wildlife